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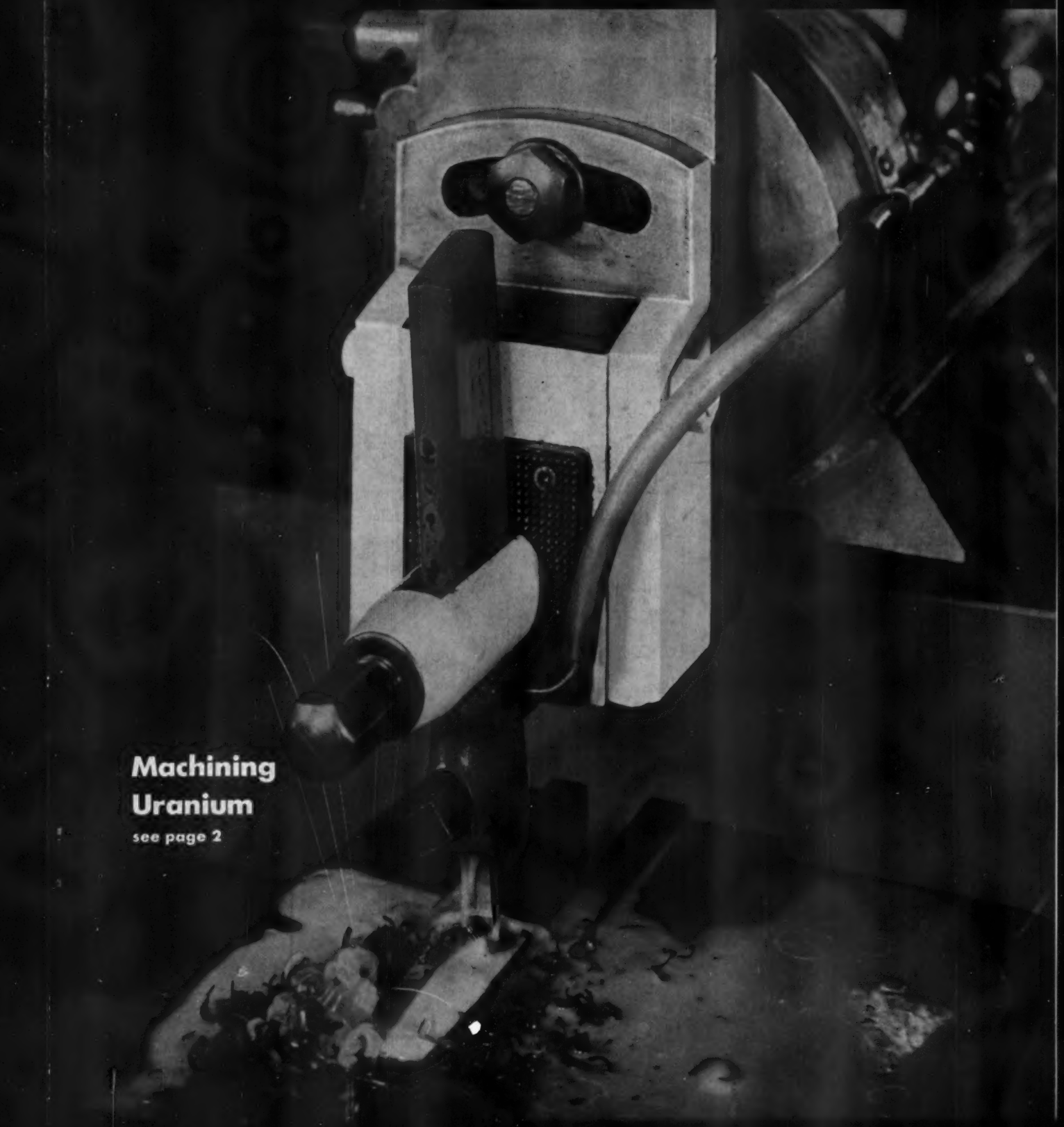
American Machinist

AUGUST 1, 1955

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION



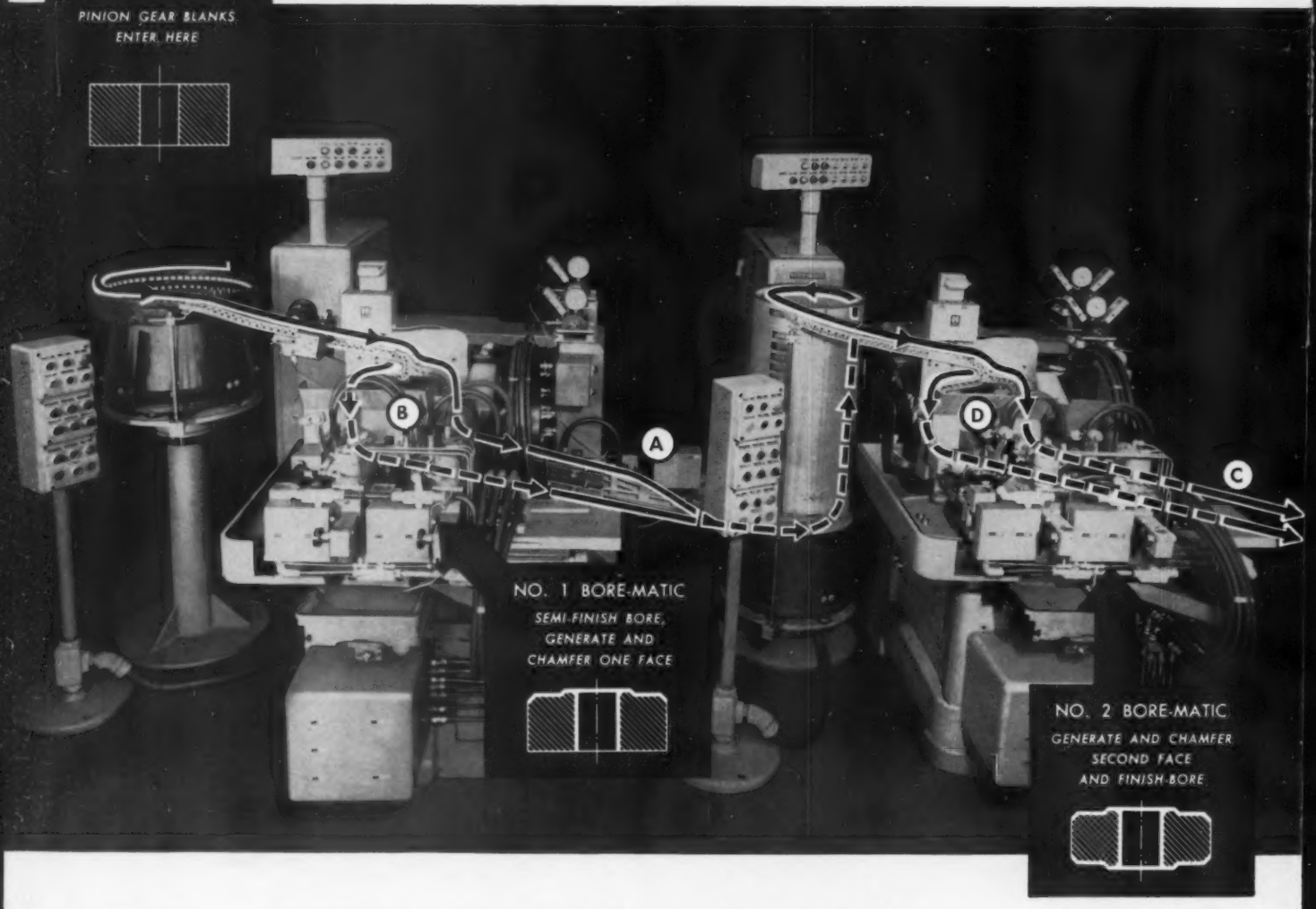
Machining Uranium

see page 2

gear-blank Borizing

COMPLETELY AUTOMATED

by HEALD



THIS HEALD automated Bore-Matic installation performs every operation completely automatically — including work holding, inspection, loading, borizing, ejection, gaging, sorting and tool setting. Here's how it works.

Parts are fed from a vibrating hopper into the loading chute of Bore-Matic No. 1, where they are inspected by a "go-no-go" gage, loaded into chucks and borized two at a time to semi finish the bore and generate and chamfer the outer face. They are then fed to the gaging station at "A" where parts are simultaneously air-gaged for bore size. Gaging data from this point is fed back to the boringheads "B", automatically advancing the tool if bore is undersize or retracting it if bore is oversize. The correctly sized parts then go to the second vibrating loader for No. 2 machine, where they are faced and chamfered on the second side and finish-bored, two at a time. At sorting and gaging station "C" they are again air gaged and boring tools at "D" automatically adjusted to correct for bore size if necessary.

This installation shows how Heald engineering and equipment fit into the modern automated production line. But no matter how much or how little automation you need.... **It pays to come to Heald!**

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CONTENTS FOR AUGUST 1, 1955

VOL 99, No. 16

ADMINISTRATION

87 EDITORIAL *Burnham Finney*
110 GUARD YOUR LIFELINE *Edwin Q Morrison*
121 PULL, BROTHERS, PULL *Round Table*

SPECIAL REPORT

111 GEARS UNTOUCHED BY HUMAN HANDS *George H De Groat*

MATERIALS CUTTING, FORMING

89 EIGHT TECHNIQUES IMPROVE SOLDERING *Gerard Olsen*
95 HOW TO MACHINE URANIUM *Alexander Denst, H V Ross*
98 UNISKAN PROCESS ROLL-REDUCES IN ONE PASS *A T Taylor*
122 EMERY CLOTH POLISHES CRANK PINS *H Koslow*
124 ACID-ETCHING USAGE *M Barash*

TOOLING

122 ANGLE-IRON SUPPORT HOLDS TURBINE ROTOR *H M James*
123 SQUARE DRIVER EXTENDS TAP *F W Smith*
123 BUSHING AIDS TURNING TAPER *M Barash*
123 HANDLES FOR POLISHING TUBES *Hjalmar Dahl*
124 DIE CURLS ALUMINUM HINGES *Hsu-Tsung Hwa*
125 PIPE THREADER DRIVES PLANER CROSSFEED *Walter Berry*
125 SCALE FOR SMALL LATHE *R Johnston*
126 UNIVERSAL JIG FOR ROUND BARS *K Gelder*
126 PIPE DRILL JIG *H J Gerber*
126 ATTACHMENT AVOIDS BROKEN TAP *P V Dunn*

ENGINEERING

102 TURRET PUNCH CONTROLLED BY CARDS *Leroy U C Kelling*
106 TAPE GIVES TURRET LATHE FLEXIBILITY *John Nichols*
129 PROPELLER-AGITATED QUENCHING *Reference Book Sheets*

SAFETY

125 REMOVE STEEL SPLINTERS *H J Gerber*
133 SAFETY REGULATIONS FOR CONVEYORS *Reference Book Sheets*

NEWS OF METALWORKING

73 SPOT NEWS
75 WASHINGTON
77 DETROIT
79 MACHINE TOOLS
83 GAGING METALWORKING
136 NEWS OF METALWORKING
142, 166 NAMES IN THE NEWS

DEPARTMENTS

66 BACKLASH
122 PRACTICAL IDEAS
129 REFERENCE BOOK SHEETS
135 TALKING SHOP
144 EQUIPMENT, MATERIALS, PARTS
158 ROUND TABLE DISCUSSION
162 NEW BOOKS

NUMBER OF COPIES PRINTED THIS ISSUE 37,836

chips

URANIUM . . . It is particularly pleasing, on the eve of the international conference on peaceful uses of atomic energy at Geneva, Switzerland, Aug 8 to 20, that we have been permitted to publish the first description of how to machine uranium metal. The manuscript, just cleared by the A E C, is from Argonne National Laboratory, source of preivous articles in *A M* on associated subjects. Our cover picture, by Joseph J Kucera, chief, Photographic Unit, Argonne (he also took the lathe machining beryllium that was our Mar 28 cover), shows a Gould & Eberhardt shaper cutting uranium; the story on machining leads this issue. Incidentally, that is *not* a left-handed shaper; our left-handed laboratory reversed the photo in processing.

NUMERICAL CONTROL. . . You will recall our detailed Special Report on Numerical Control (*AM*, Oct 25 '54, p 133). Now, on the eve of the Machine Tool Show, we give case studies of application of the idea. Here are descriptions of a lathe run by tape; a punch press by cards. These are amazing machines, which, once fed information, go right ahead producing. Here is tomorrow's processing of tough jobs.

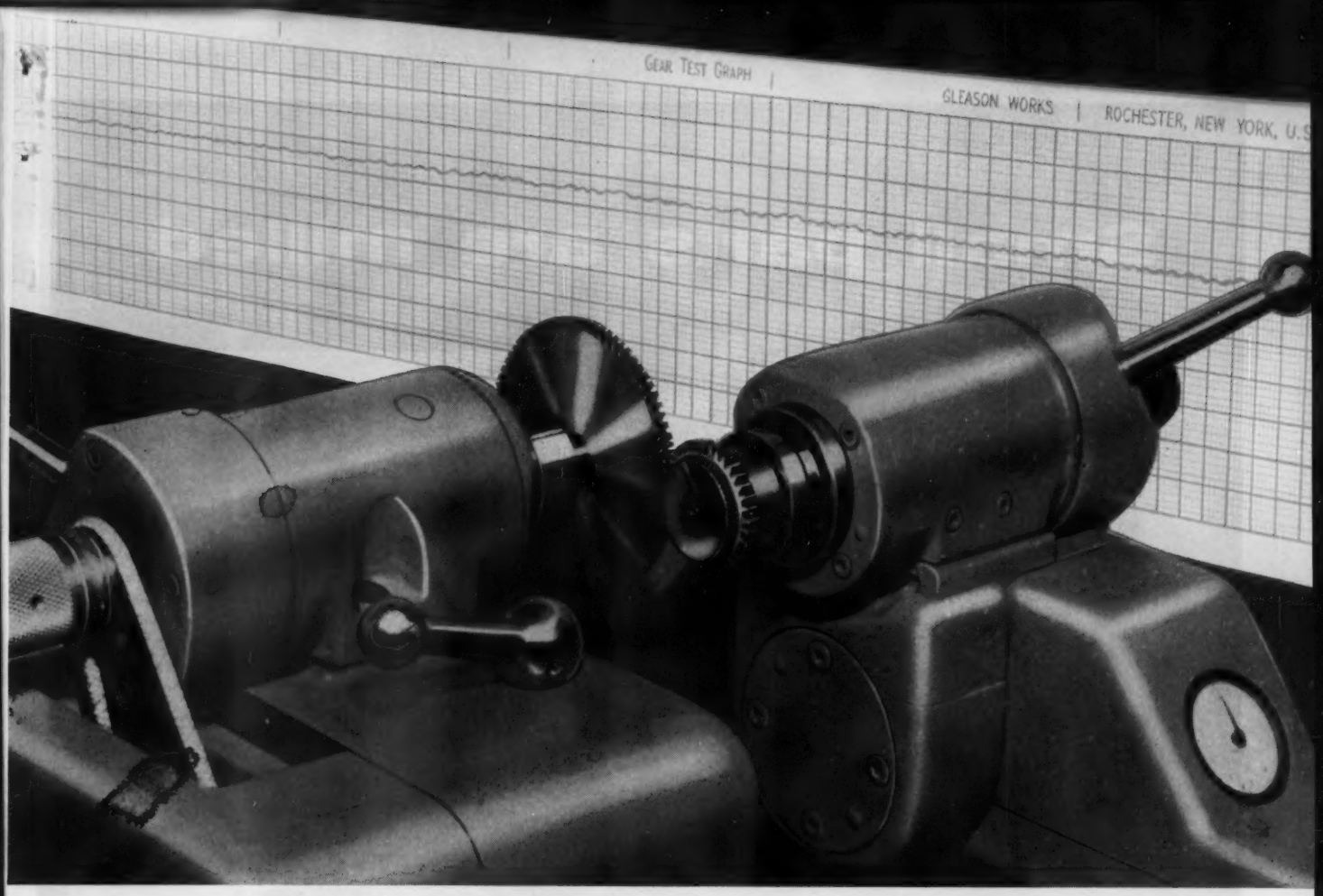
PINIONS . . . For the past year, we have been gnawing our lips, wanting to tell you about the Buick pinion line, a fabulous collection of automated equipment beautifully put together. At long last, Buick has released our story, so it forms a current Special Report. Here, in pictures, are the setups; in words, the reasoning behind the installation, by the man who bossed the job (see biog).

UNISKAN . . . A T Taylor, Hanford Atomic Products Dept, G E (note two articles on atomic power subjects in this issue), describes tooling and equipment tested for uniskanning zirconium, aluminum, nickel and mild steel. Uniskan? Oh, that's a fancy word invented by R C A for what we've called roll-flowing or roll-reducing. It's made up of *uni*, meaning one, and *skan*, meaning pass. Equipment is simple and results worth your looking at.

SOLDERING . . . Techniques, including special irons, flux applications, solder preforms, furnace soldering, induction soldering, etc, are assembled in a 6-page foldout insert in this issue. Gerard Olsen, foreman at Ford Instrument Co, Long Island City, N Y, gave us so much material and such good pictures we decided to feature it in a 6-page fold-out insert. The story covers hermetic sealing of nickel-plated aluminum, but the ideas are broadly useful. Extra copies are available as long as our supply lasts. Just address our Reader Service Department.

COMING . . . *A M* for Aug 15 will include a Special Report on how to work titanium (16 pages of new data), plus articles on plastic dies, value analysis, trends in furnaces, and Boeing's new setups for the B-52. There is also an unusual article describing that underwater miller at Westinghouse and a cover picture showing it in full color.

GEAR MAN . . . Frank W Albro, creator of Buick's new automatic gear line (described in our current Special Report), has more than 35 years of experience on transmission gears and machinery design—all in his home town, Flint. He joined Buick in 1918 as a 19-year-old tool designer, and except for 11 months absence in 1920, has been in Factory 40 ever since, as draftsman, foreman, process man, and since 1949 as asst master mechanic. Some of the projects he helped to develop include the method of making tank transmissions and power trains in World War II and development of a cross-drive tank transmission during the Korean conflict. He first proposed the automatic gear line in March '53; the intervening time has been spent in developing machines, gages and distributors to do the job. He was married in 1926, has two children, Dorothy, 23, and Frank, jr, 18.



Make a complete test and record of your small spur and helical gears

You can be certain that your spur and helical gears will operate correctly in their final mountings if you give them a complete test *before* actual assembly.

The new Gleason No. 104 Spur Gear Tester gives you a complete check of your gears. A rolling test for composite error provides a quantitative check of tooth spacing, profile shape and runout.

In this test, the gears are slowly rotated while a calibrated spring load keeps them in metal-to-metal contact. Any error in the gears results in a horizontal movement of the drive spindle. A completely electronic pickup and recorder make a *permanent* chart of the results.

But there is still another test you can make with the No. 104 Tester—a running test, which simulates actual operating conditions, determines the smoothness of operation, noise characteristics, and tooth contact, which will actually be obtained when the gears are used.

This machine tests precision and commercial gears up to 4½″ center distance.

We will gladly furnish further information on the No. 104 Spur Gear Tester. Write for our bulletins.

The No. 104 Tester is furnished complete with an electronic pickup and recorder unit, as shown above.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

51

Small parts are milled

Quick

Trays of sewing machine parts are briefly parked nearby for a quick milling operation on CINCINNATI No. 000-4 Two-Unit Automatics. Machines of this type are the smallest of a large family of Cincinnati automatics, ranging up to the 168" table travel Hy-Powermatic.

MACHINE TOOL SHOW
INTERNATIONAL AMPHITHEATRE
CHICAGO, ILL.
SEPT. 6-17, 1955

BOOTH 1205

CINCINN

as a wink

ON CINCINNATI No. 000-4 AUTOMATICS

Nearly every mechanical or electrical device incorporates a number of small parts. If you can hold several of them in your hand, and they're manufactured in big volume, you have the proper setting for low-cost production on CINCINNATI No. 000-4 Unit Type Automatics. ¶ These small, rapid-cycle milling machines are available as one, two or four machines, independent of each other and mounted on a common base. This construction offers a unique advantage. The quadruple unit machine, for example, can be tooled up for single milling operations on four different parts; for four progressive operations on the same part; for the same milling operation on four parts simultaneously. Any one or all of the units can be put to work. ¶ It will be to your advantage to seriously consider the CINCINNATI No. 000-4 Unit Type Milling Machines for the production of your small parts. You will find brief data in Sweet's Machine Tool File; complete specifications in our catalog No. M-1677. Write for a copy.

THE CINCINNATI MILLING MACHINE CO.
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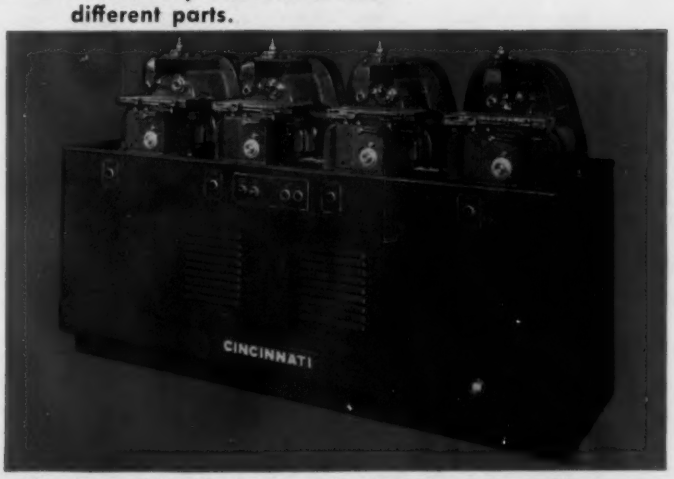
1 **One unit. For moderate rate of production.**

2 **Two units. For high production; two progressive operations; moderate production of two different parts.**



4 **Four units. For high production; four progressive operations; moderate production of four different parts.**

ATI

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MILLING MACHINES • CUTTER SHARPENING MACHINES • BROACHING MACHINES • METAL FORMING MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

THE PRECISION

LINE

AT THE SHOW . . . BOOTH 1416

Don't miss seeing the latest developments in The Precision Line of Fellows Gear Production Equipment. If you don't make it to the Show . . . then it will pay you to contact your nearby Fellows Office for the latest facts.

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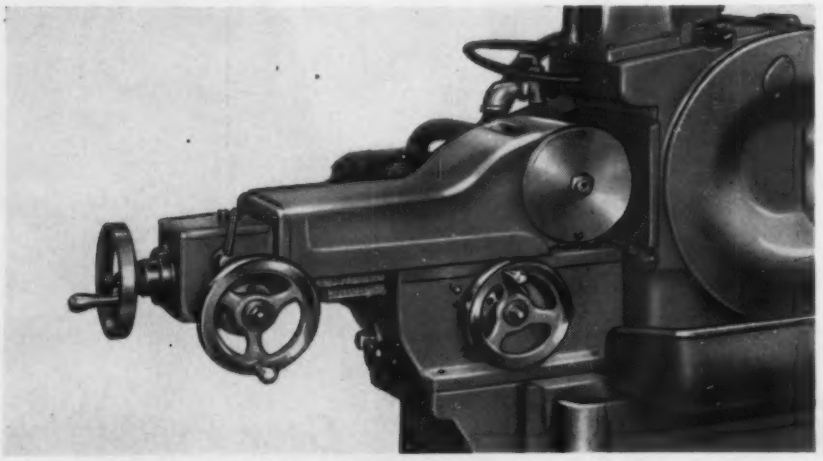
CENTERLESS GRINDER

Actually three machines in one. (1) The revolutionary Diversimatic is a standard centerless grinder for thru-feed work . . . (2) a standard grinder for in-feed jobs . . . (3) equipped with the Crush Dressing Attachment, it can grind complicated forms which can be ground no other way. The Diversimatic finish grinds small parts from solid . . . or finish grinds rough-turned parts. It grinds faster, holds closer tolerances, resulting in lower cost per piece.

The Diversimatic is an ideal machine for grinding a great variety of small parts made of metal, plastic, glass, etc. Especially suited for grinding parts used in business and office machines, sewing machines, electrical appliances, aircraft, automobiles, munitions, and similar work. Call, write or wire for full facts, today. See for yourself how this versatile grinder can cut your costs.

EXCLUSIVE CRUSH-DRESSING ATTACHMENT INCREASES SCOPE OF GRINDING OPERATIONS



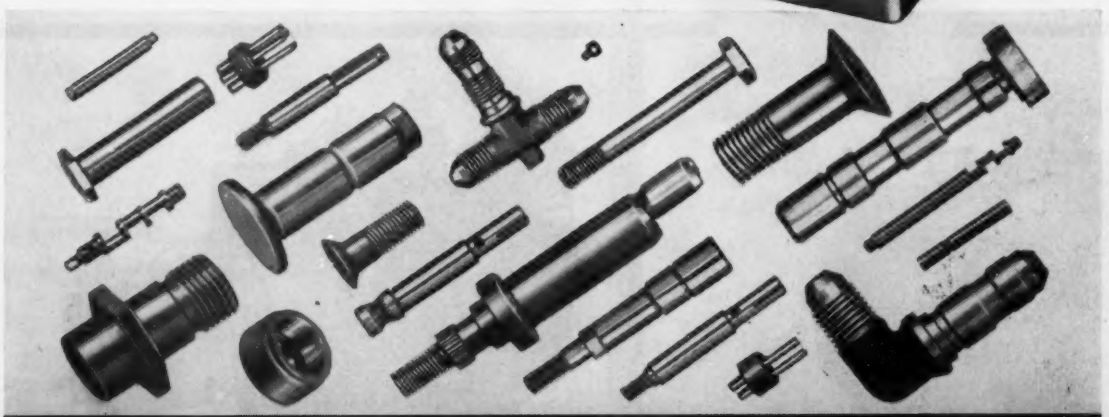
It crushes the wheel to the desired contour, and holds the form, allowing hundreds of pieces to be ground between wheel dressings, imparting the exact profile to the work.

VAN NORMAN

MANUFACTURERS of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

Grinding of Small Parts...

Work Size: 0-1½" Diam.
Grinding Wheel: 14" O.D. x 4" wide
Regulating Wheel: 8" O.D. x 4" wide
Automatic cycle optional



GRIND PARTS LIKE THESE FASTER, MORE ECONOMICALLY . . .

Don't wait . . . for extra profits install a Van Norman Machine now!
They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company.

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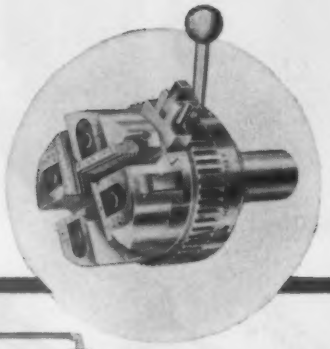
COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

Cutting, Grinding, Tapping,



Cutting....

The 8C LANDMACO — one of five new Thread-Cutting machines to be demonstrated. These machines are designed for precision threading of workpieces from 3/16" to 6-5/8" in diameter. Above is the new 2" LANDMATIC — one of the many Standard and Special Thread-Cutting Heads on display designed for application to Automatics and Turret Lathes.

Grinding....

The CENTERLESS Thread Grinder—to be shown in operation — for infeed and thrufeed grinding of threads for 1/16" to 4" in diameter at mass production rates.

Rolling THREADS

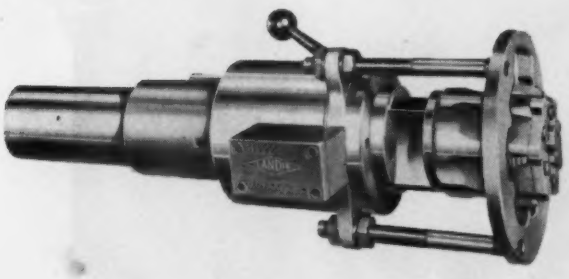
The latest Machines and Tools for producing threads by all of these methods will be shown—set up for operating demonstrations.

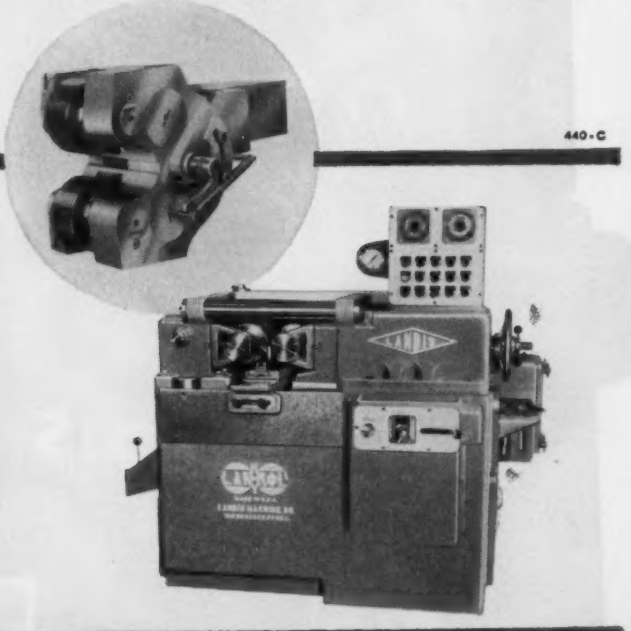
Most of these will be on display for the first time—the revolutionary LANHYROL Thread Rolling Machine, the new Model C LANDMACO Bolt Threading Machines, and the #1 Automatic Close Nipple Machine.

Experienced Thread Engineers will furnish any information desired about the more than 350 sizes and styles of LANDIS Threading Tools and Machines, and will be glad to discuss any problem dealing with method, equipment, or thread design.

LANDIS *Machine* COMPANY

WAYNESBORO • PENNSYLVANIA • U. S. A.





440-C

Tapping....

The LL Collapsible Tap for producing internal tapered threads featuring detachable heads for wide range coverage. On display will be Rotary or Stationary Standard Taps for straight or tapered threads, Solid Adjustable Taps, Valve Taps, and Taps for other special applications.

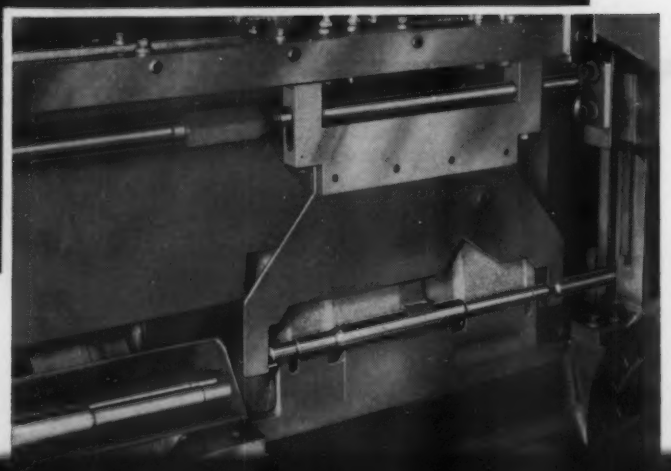
Rolling....

The new LANHYROL Thread Rolling Machine—shown in a variety of demonstrations—revolutionary in its output, accuracy, and flexibility. Above is the #20 LANROLL Attachment—one of five sizes of Thread Rolling Attachments for Automatics and Turret Lathes to be displayed.

Cuts Both Grinding and Inspection

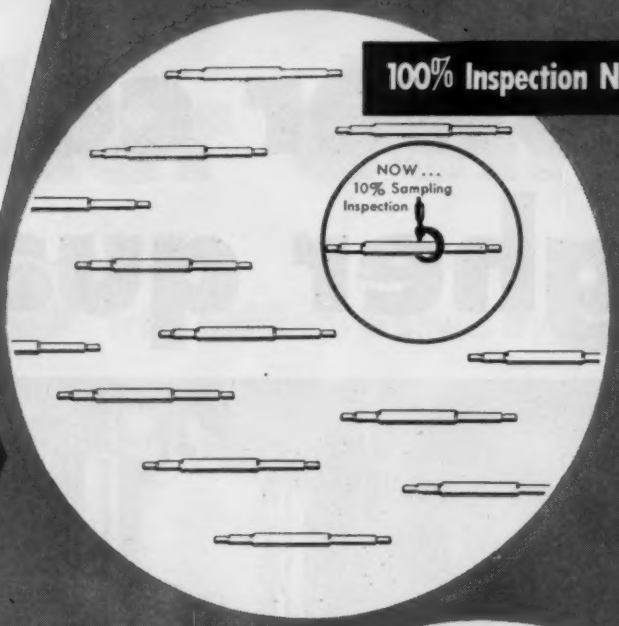
Improves work uniformity from .0007" to .0003"

Since using two Landis No. 12½ Centerless Grinders, a major automotive parts manufacturer is now grinding shafts with these results. The superior accuracy of these grinders at high production rates is due to their unmatched rigidity.

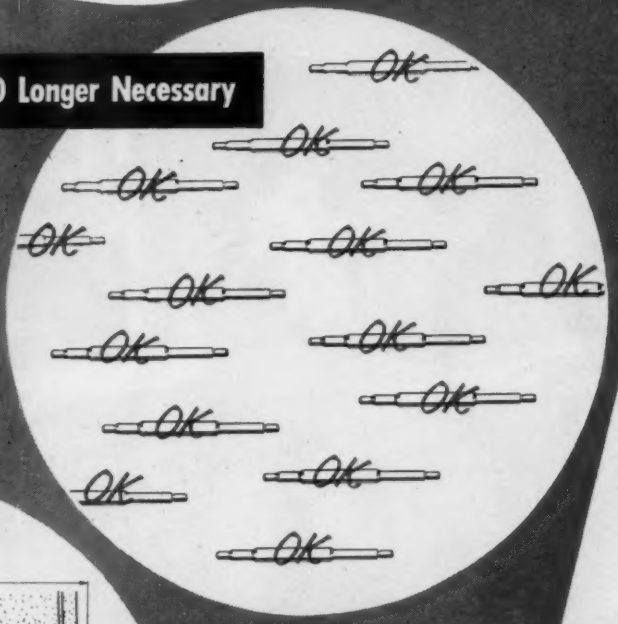


#12½ Centerless Grinder with automatic loading and unloading.

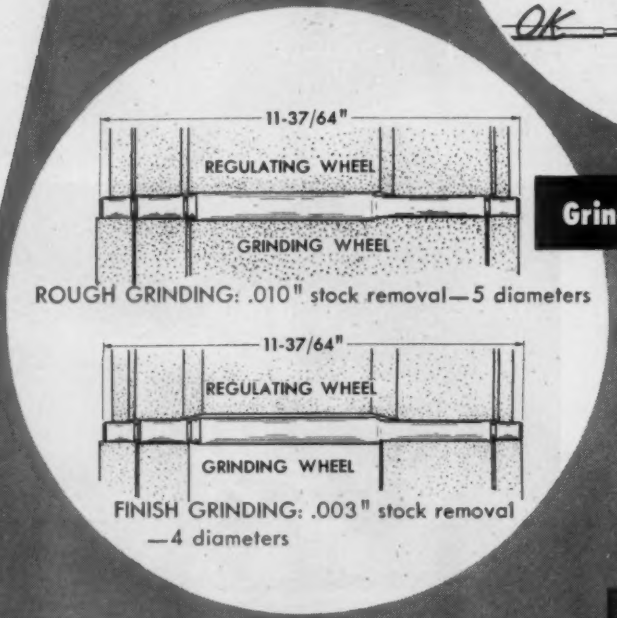
Costs



100% Inspection NO Longer Necessary



10% Re-runs NO Longer Necessary



ROUGH GRINDING: .010" stock removal—5 diameters

FINISH GRINDING: .003" stock removal —4 diameters

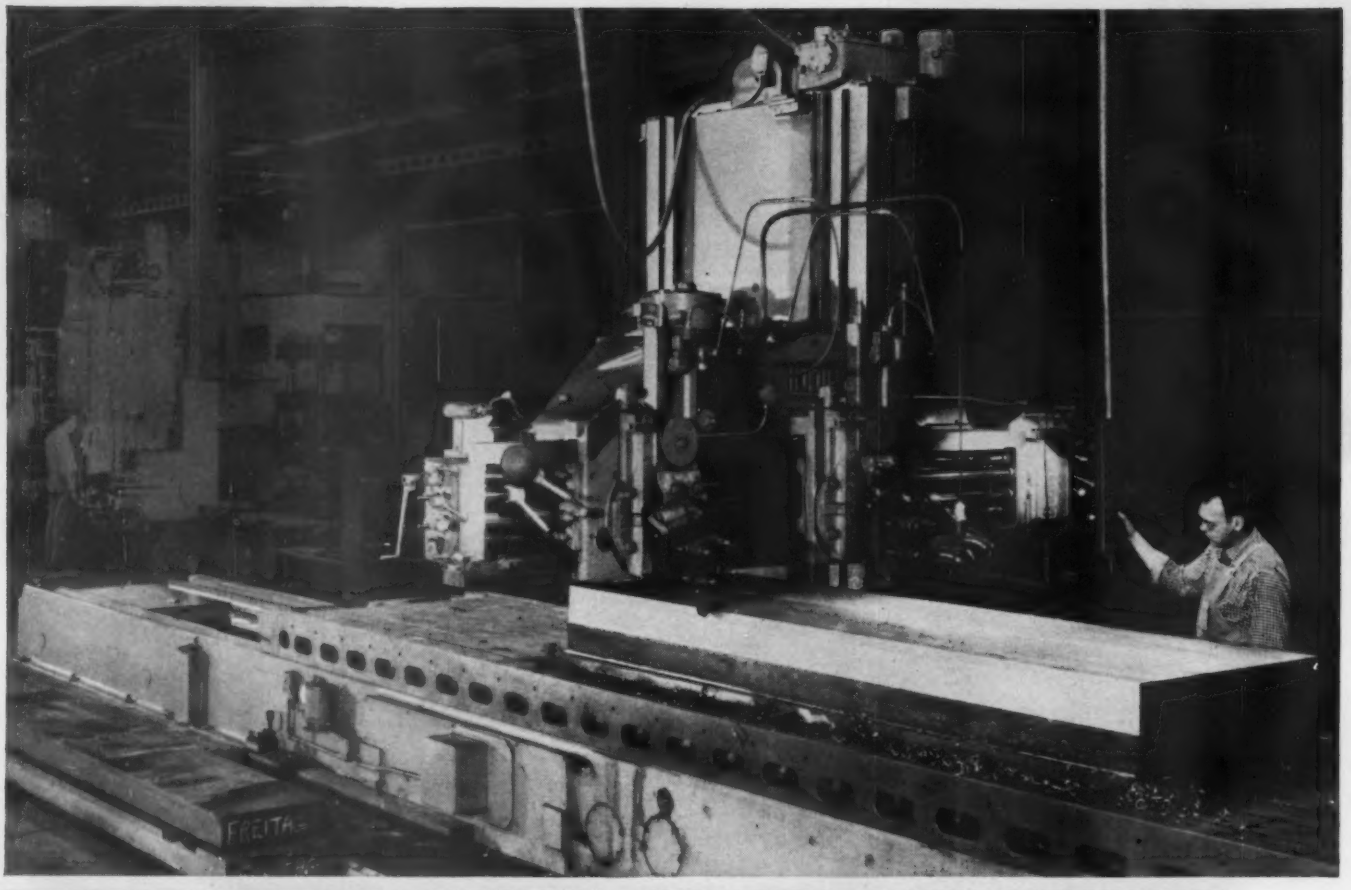
Grinds 380 Shafts per Hour

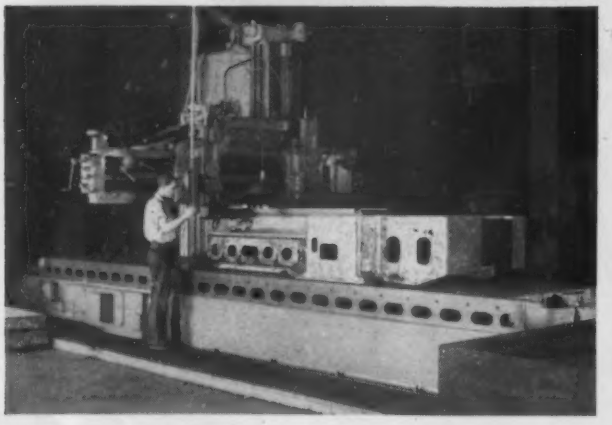
Booth 1117

LANDIS TOOL COMPANY
WAYNESBORO, PENNA.

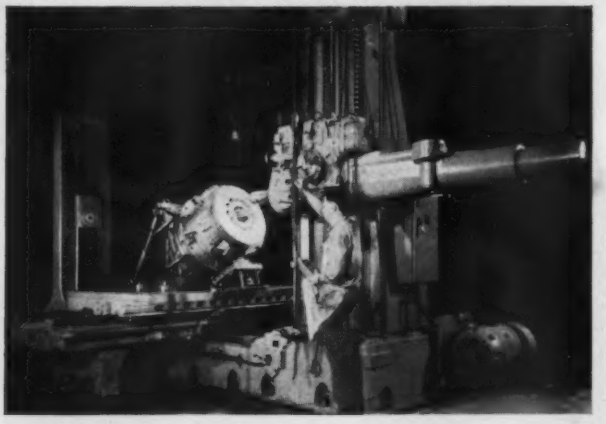
LANDIS
precision grinders

Lower costs...
...higher quality





Here's a typical example of a large workpiece being planed on a Giddings & Lewis 62" x 60" x 24' Openside Planer. The planer's openside construction simplifies setup of unusually large workpiece that requires the full range of the machine. What's more, it holds tolerances within ten-thousands and provides greater flexibility of operations at high speeds.



This special mold for a die-cast engine part is precision-machined to close tolerances on Giddings & Lewis' Model 350-T Horizontal Boring, Drilling and Milling machine. The 350-T is equipped with extended saddle and saddle supports, also a micrometer measuring device which permits readings to .0001" of vertical travel of headstock and cross travel of machine table on the saddle.

quicker delivery parts with Giddings & Lewis Hypro Openside Planers and Model 350-T Horizontal Boring, Drilling and Milling Machines

—says report from R. H. Freitag Manufacturing Co.

MANUFACTURING plants everywhere depend on R. H. Freitag Mfg. Co. of Akron, Ohio to produce superior products to exact limits of precision at lower cost. Contributing to this outstanding ability are four Giddings & Lewis precision machines which provide the means to faster cutting, heavier cuts, better finishes and above all greater accuracy.

Extremely versatile, the G&L's are the busiest machines in Freitag's modern machine shop. They produce many intricate parts required in the manufacture of aircraft, automobiles, tools and dies, and components for other major industries.

Two heavy-duty Model 350-T (Table type) Horizontal Boring, Drilling and Milling machines (5" dia. spindles) are equipped with extended saddle and saddle supports. They also feature an Automatic Electric Positioning Device which selects and controls the distances between machined holes. In addition, there are two G&L Hypro Openside Planers—a 48" x 48" x 32' machine and an extra heavy-duty 62" x 60" x 24'.

For more information on how machines like these can help you perform an exceptionally wide variety of operations, see your Giddings & Lewis representative, or write direct to factory.

GIDDINGS & LEWIS MACHINE TOOL CO.

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BOOTH NO. 710

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Tungsten Carbide Gages, Wire Type .010" to .365" dia.

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In response to persistent demand, VK has developed and now announces a new, ultra-fine, plain plug gage tolerance of .00001", designated as Class XXX. This new tolerance, half of that of Class XX, satisfies a need, long evident, for gages to meet part limits finer than .0002", and permitting only ten millionths of an inch total variation on the gage in sizes up to .825" diameter, and only fifteen millionths in sizes from .825" to 1.510" diameter. Tolerance may be applied either bilaterally or unilaterally.

Inasmuch as Class XXX tolerance must take into account such factors as finer diameter variation, a high order of roundness control, an exceptional surface finish and an extreme resistance to wear (all of which offset the shallow wear depth inherent in such a gage class), Class XXX is offered in only Chromium Plated and Carbide Gages.

VK Class XXX Plain Plug Gages are furnished in the materials, styles and ranges shown in boxed panel above. VK also furnishes Class XX, X, Y, and Z standard tolerance plug gages in wire type, taper lock and trilock designs. For complete information address: The Van Keuren Company, 173 Waltham St., Watertown, Mass.

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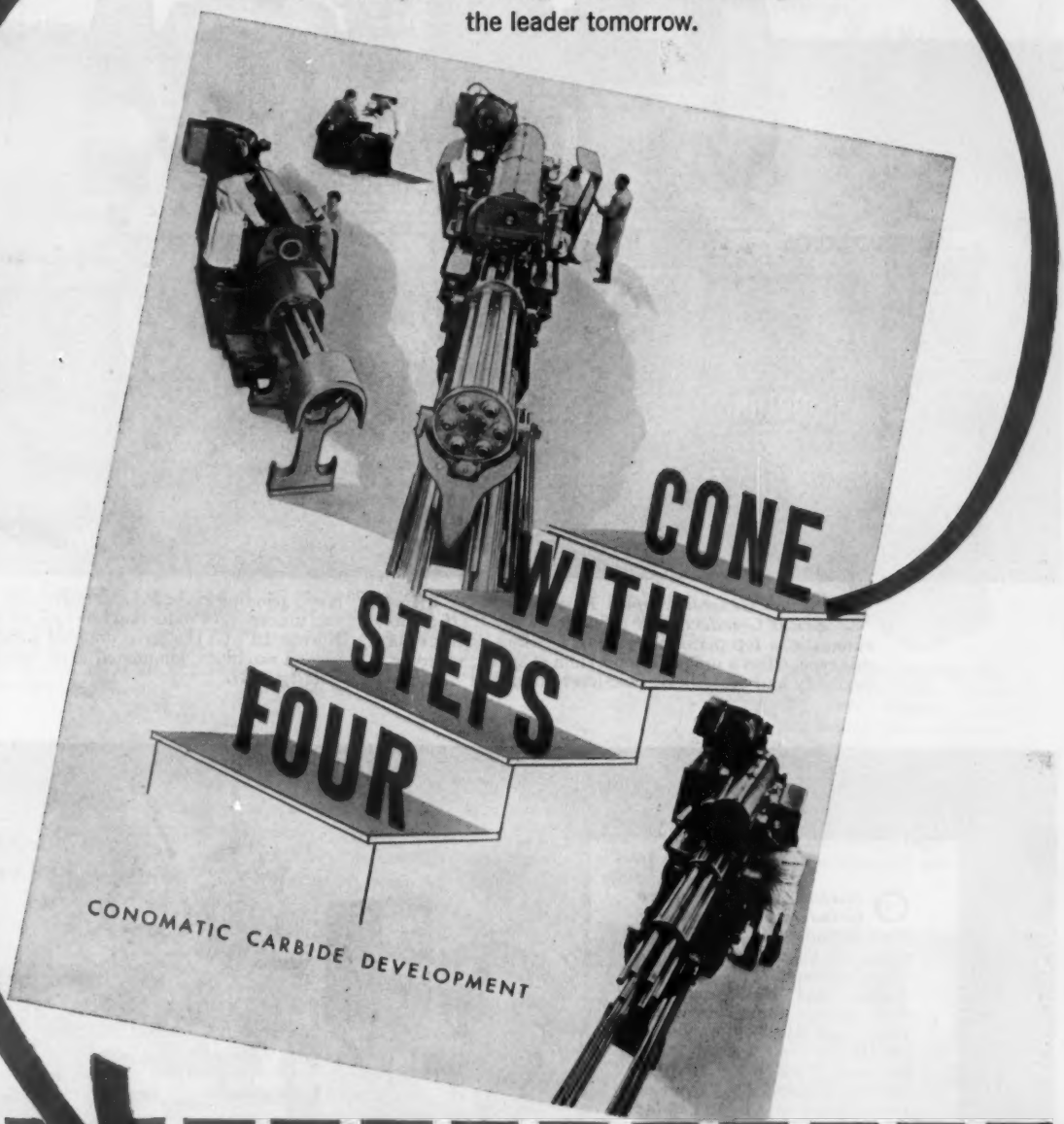
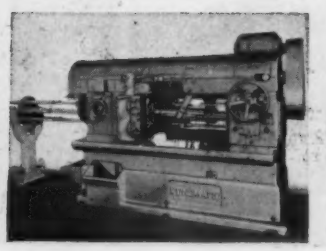
If you haven't read this important booklet, your production line may be operating at less than peak efficiency. Your operations may be beating competition with HSS today, but you will likely need carbide tooling to be the leader tomorrow.



Write for your free copy of this important booklet today!

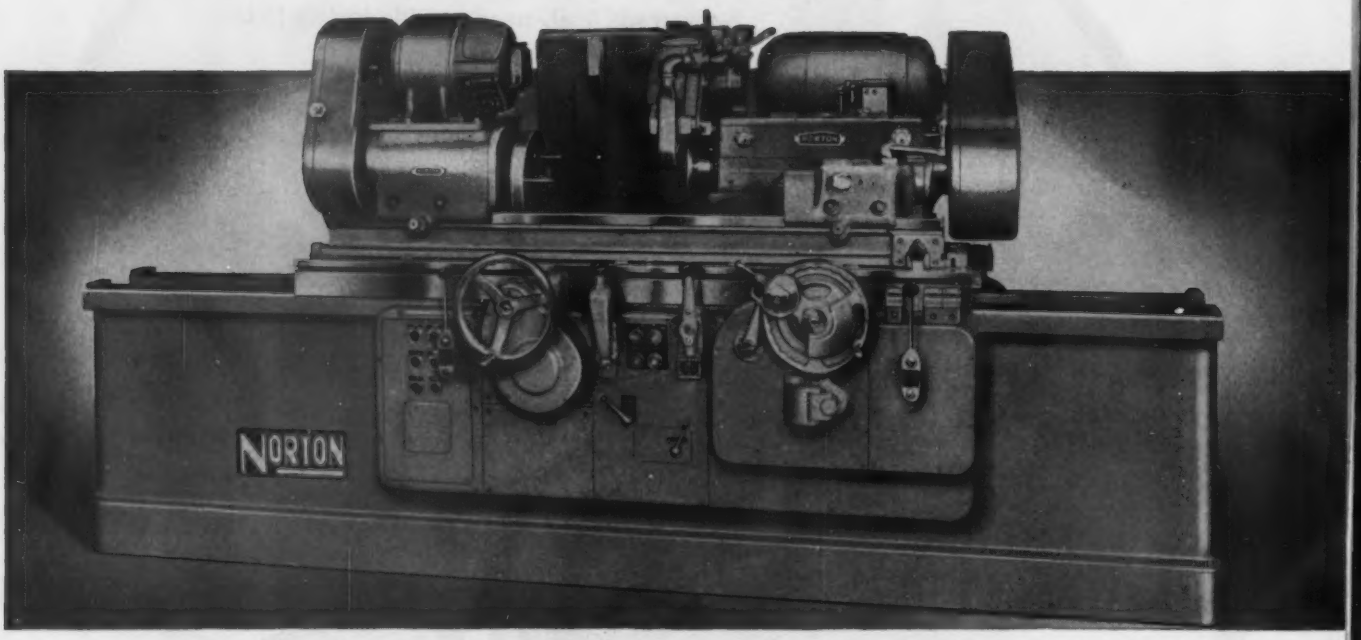


Conomatic

THE MACHINE TOOL SHOW CHICAGO, ILL. BOOTH 401

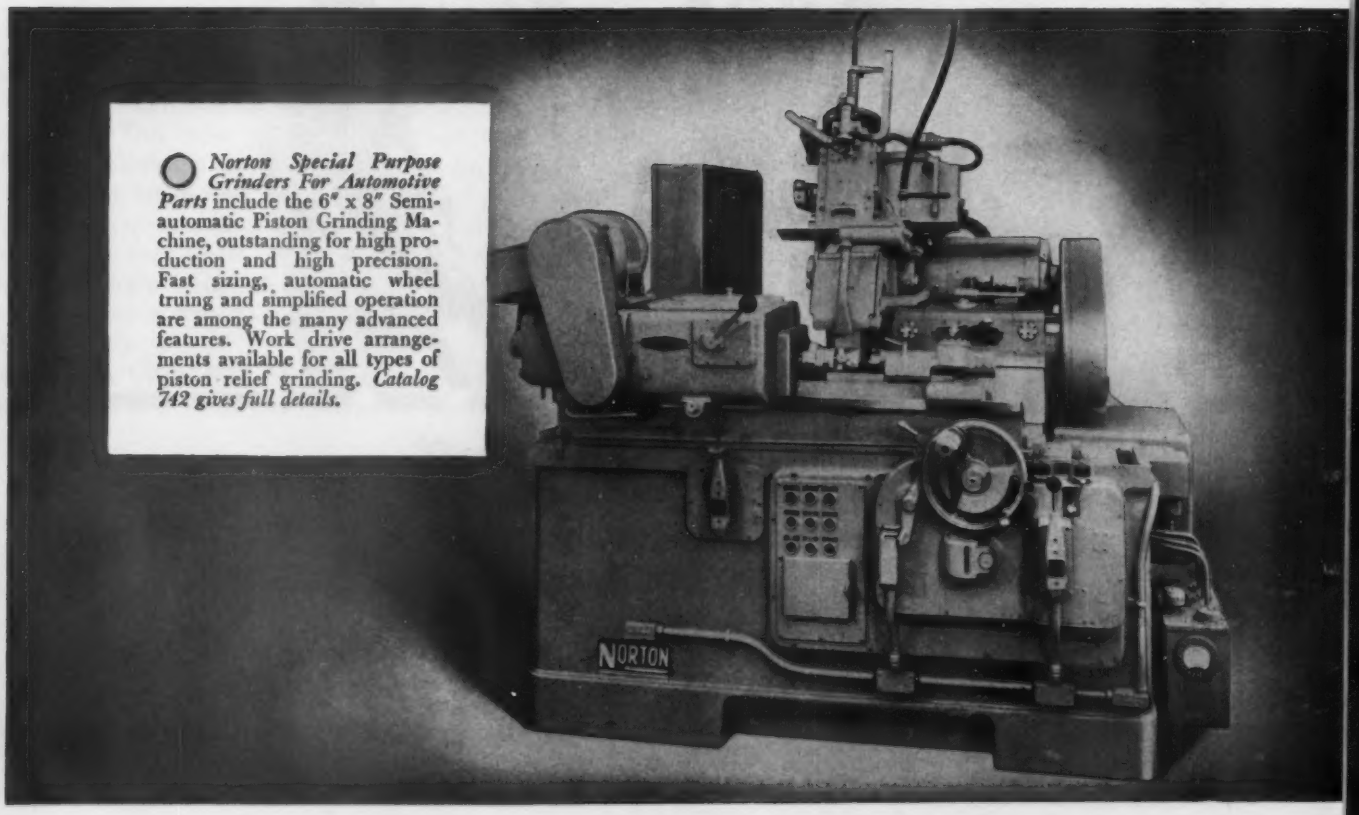
CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

6 from the world's most



○ *Norton General Purpose Production Type Cylindrical Grinders.* The 10″ x 36″ Type CTU Semi-automatic, a top performer among grinding machines of this type, offers a unique combination of speed, accuracy, flexibility and sturdiness. One-lever control of the automatic grinding cycle reduces operator's duties to loading and unloading. Production line and job shop users report Norton 10″ CTU's have doubled production, replaced several machines, eliminated extra operations. *Write for Catalog 1787.*

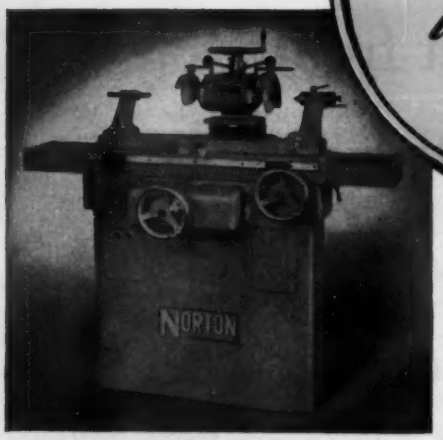
○ *Norton Special Purpose Grinders For Automotive Parts* include the 6″ x 8″ Semi-automatic Piston Grinding Machine, outstanding for high production and high precision. Fast sizing, automatic wheel truing and simplified operation are among the many advanced features. Work drive arrangements available for all types of piston relief grinding. *Catalog 742 gives full details.*



complete line of

money-saving grinders and lappers

Norton Surface Grinders are well represented by this 8″ x 24″ Hydraulic Grinder. Designed with both hand and power table traverse and cross feed, it produces plane surfaces smoothly and speedily. Convenient controls and easy accessibility keep operating and maintenance times low. Extra equipment, such as magnetic chucks, wet grinding attachment and individual dust exhaust system meet all operating conditions. *Write for Catalog 190.*



Norton Tool Room Cutter Grinders. The No. 20 Cutter and Tool Grinder is the most versatile machine in its class. The wheel head tilts up to 15° above or below horizontal, and may be swivelled through 360° — simplifying such jobs as grinding taper reamers, step counterbores, form tools and milling cutters. Other pace-setting advantages include long table traverse and wheel slide travel . . . integral motor spindle . . . wheel slide graduated dials readable from any angle. No other cutter and tool grinder does so many jobs so fast, so easily. *Catalog 189 tells you why.*

Norton Lapping Machines. The Type 16FC Vertical Lapper brings you outstanding production capacity for such work as diesel injector parts, plug gages, size blocks, sides of small bearing races, pump gears and plates and many other parts. Laps flat work up to 3″ x 5″, and cylindrical work up to 3″ diameter, producing a high degree of accuracy and finish. *Catalog 212 gives you details.*

Only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost.

The six machines shown here are typical products of that experience — bringing you ahead-of-the-parade design that speeds production and adds maximum product-value on every job they do for you.

But remember — these six advanced machines represent only a small fraction of the world's broadest line. Besides many models of cylindrical, surface, crankshaft and camshaft grinding machines, Norton produces a wide range of lapping machines, tool room grinders and special types for grinding pistons, valves, jet parts, etc.

A new illustrated folder #1843 lists the entire Norton line of grinding and lapping machines and tells you how to get all the facts on each unit. For your copy, write to NORTON COMPANY, Machine Division, Worcester 6, Mass. *In Canada:* J. H. Ryder Machinery Co., Ltd., Toronto 5.

Norton 10″ Universal Grinders. The 10″ x 20″ Universal Grinder has the flexibility to handle an almost endless variety of jobs. Compound swivel arrangement of wheel head enables you to make separate angular settings of wheel and feed. External, internal, face or angular wheel slide operations are easy. Chuck may be mounted on one end of work head spindle, ready for use by turning head 180°. *Write for Catalog 170.*

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Making better products . . . to make other products better

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WOULD YOU SPEND

for all the production you can get from this new 10hp No. 2 Model CK universal milling machine? That's all it would cost you under...

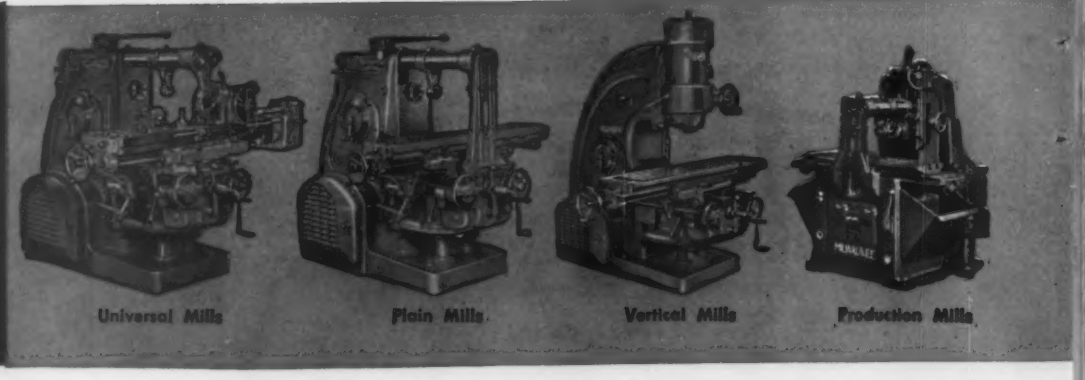
For additional data on this machine, see our catalog in Sweet's.

Kearney & Trecker's

TOOL-LEASE

PROGRAM

Kearney & Trecker manufactures a complete line of more than 250 standard knee and bed type milling machines and precision boring machines.



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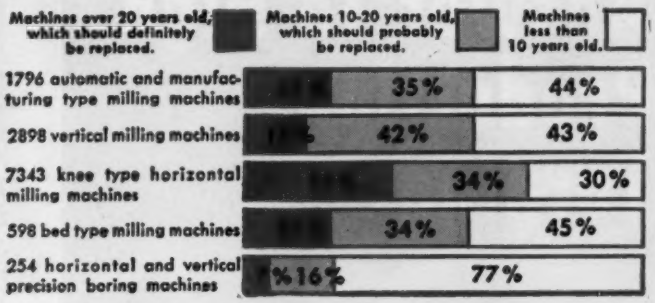
47½ CENTS PER HOUR

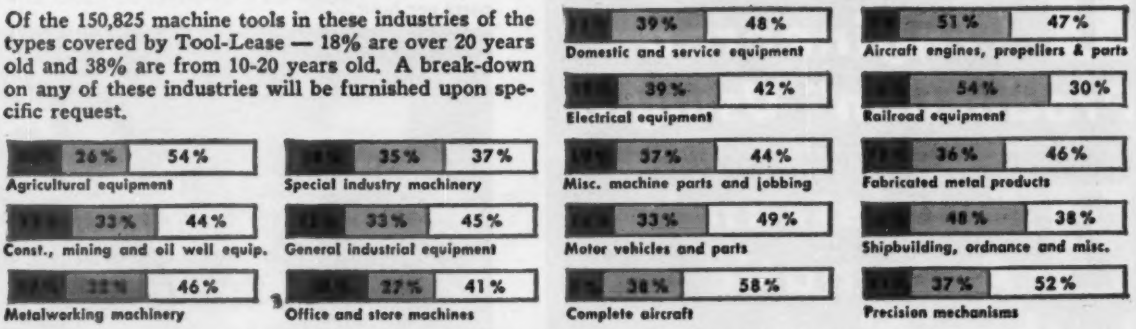
LET'S LOOK AT THE OBSOLESCENCE PICTURE IN THE SPECIAL INDUSTRY MACHINERY FIELD

Includes machines for food-products, textile, woodworking, paper industries, printing, glass-making, cement-making, incandescent lamp-making; paint-making, rubber-working, tobacco-products, shoe-making, and stone-working; smelting and refining equipment. Of the total 12,889 machines in use today which can be replaced by Tool-Lease equipment — 28% are over 20 years old, over 36% are 10 to 20 years old!



HERE'S THE OVERALL PICTURE IN THE ABOVE AND 15 OTHER BASIC INDUSTRIES

Of the 150,825 machine tools in these industries of the types covered by Tool-Lease — 18% are over 20 years old and 38% are from 10-20 years old. A break-down on any of these industries will be furnished upon specific request.



Figures adapted from 1953 American Machinist survey of metalworking industry

HERE'S another popular knee-type universal milling machine, packed with outstanding design and operating features. It's available for your immediate needs under Kearney & Trecker's Tool-Lease program.

Under Tool-Lease Plan "A," one of three seven-year lease agreements offered by Kearney & Trecker, you make two semi-annual rental payments, totaling 25% of the machine's price during each of the first three years. Actually in dollars and cents, you pay 47½ cents per hour for this new 10 hp No. 2 Model CK universal milling machine. That means a machine installed in your plant and in operation — *literally for pennies an hour!*

What's more, under Tool-Lease, you can rent any of over 250 different types and sizes of standard milling machines or precision boring machines. All are available under three basic plans, with varying options to continue or terminate the lease, or to purchase the equipment. If you require special machinery or heavy-duty CSM bed types, special agreements will be considered.

For complete information on Tool-Lease, see your Kearney & Trecker representative or mail coupon to Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.

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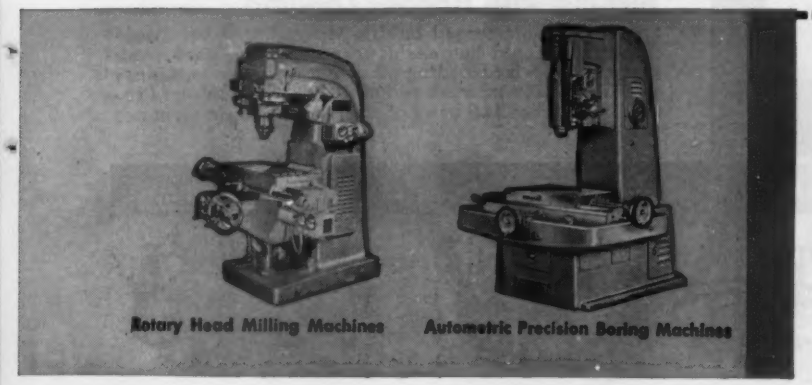

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Automatic Precision Boring Machines

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Please send me Bulletin TL-10A on Tool-Lease Program and booklet titled "Critical Picture of Creeping Obsolescence."

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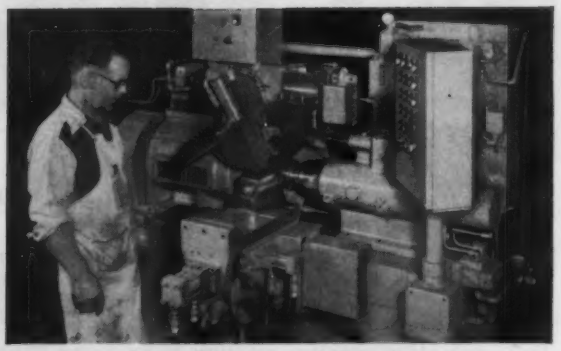
Here's Your Answer To High Production Turning:

1 Sundstrand *"Engineered Production" Using...*

2 Sundstrand *Automatic Lathes Plus...*

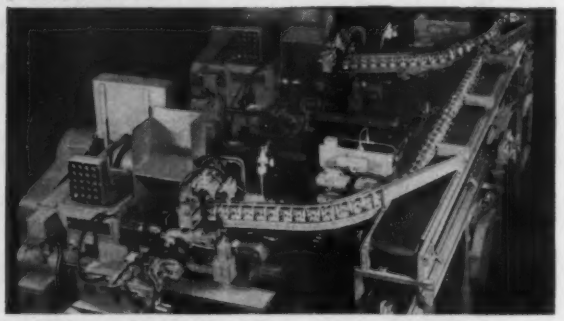
3 *Automatic Handling*

Sundstrand "Engineered Production" means designing and building machinery for the job at hand while using all the skill and advanced facilities available. For instance, here are seven interesting lathe installations, each of which is provided with automatic work handling coupled with automatic machine cycling . . .



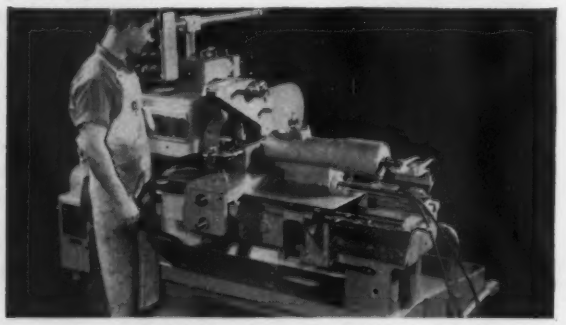
Turning, Handling and Gaging Automatically

Automatic handling, machining and gaging of stator cores is performed on this Sundstrand Lathe. Parts are fed in by gravity, automatically loaded, turned, chamfered, gaged and ejected. Gaging is interlocked with automatic tool advancement of .0005". After 5 settings, the machine stops automatically for tool changes. Production is 154 parts per hour.



Turning, Facing, Chamfering and Grooving 376 Pistons Per Hour

Continuous automatic cutting cycles of these two Sundstrand Lathes combine with automatic loading, unloading and conveyance of parts for a high degree of automation in machining automobile pistons. Each machine turns, faces, chamfers and grooves for a total production of 376 pistons per hour.



Turning with Hopper Loading

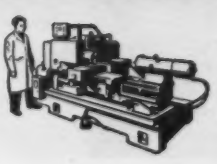
Spacer tubes are turned on this Model 6A Lathe. Everything is done in automatic programed sequence from gravity hopper feed loading (above the turning operations) to final ejection of work to unloading chute below. Production reaches 136 parts of steel and 68 of titanium per hour.

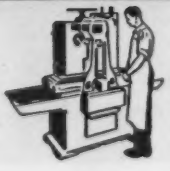
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

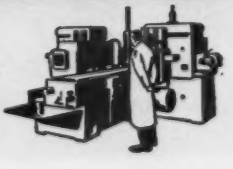
SUNDSTRAND

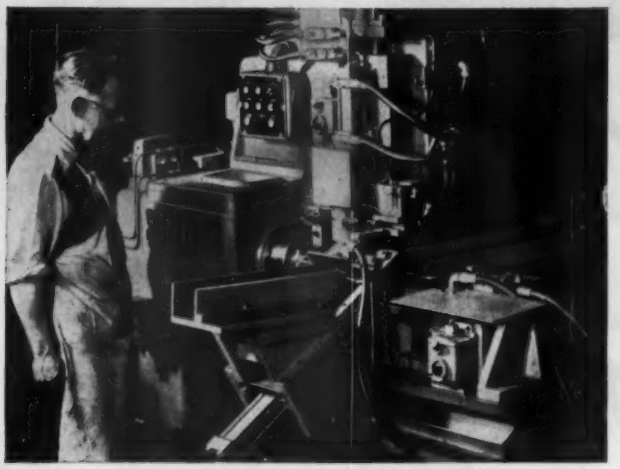
50 YEARS OF *"Engineered Production" Service**

*REG. U.S. PAT. OFF.



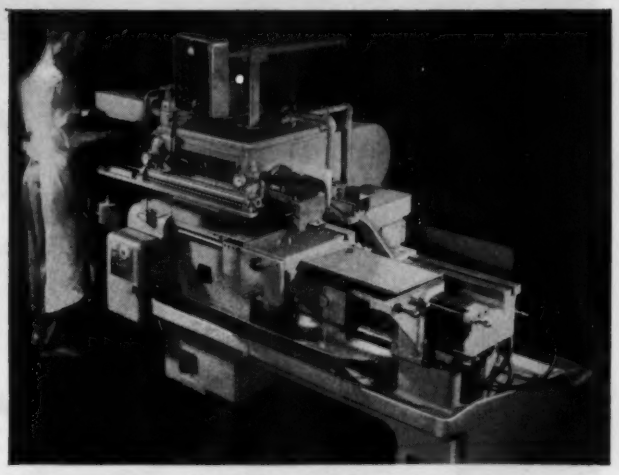






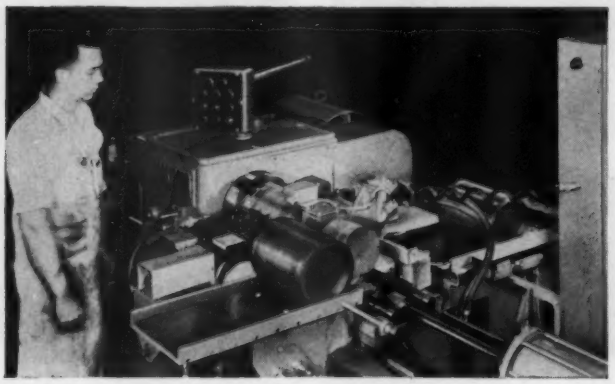
Facing and Chamfering Both Ends of 240 Stator Shells Per Hour

Facing and chamfering both ends of stator shells is done by automation of this Model 6A Automatic Lathe. A finger picks a part from the inclined loading chute and positions it for spindle loading. The part is machined on both ends simultaneously and then ejected into the unloading chute.



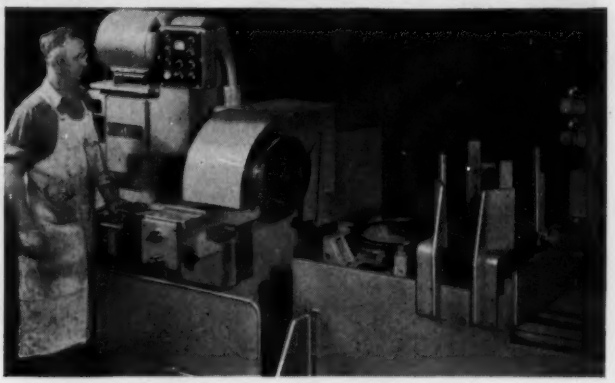
Hopper Loading Through Spindle

This example, a steering actuater screw, lends itself to a different type of automation. Here the work, coming from a gravity feed hopper is pushed through the spindle at the back to a positive stop and clamped for turning and grooving the end. After the cut, the part is automatically released and pushed into the unloading chute by another incoming part. Production is 240 pieces per hour.



Turning Diesel Engine Pistons

Several different models and sizes of diesel engine pistons are turned by automation of a Sundstrand Model 8A Lathe. The part is released from the loading chute, pushed on the driver, turned, grooved and faced, then pulled off the driver and released into the unloading chute.



Turning 165 Ring Gears Per Hour

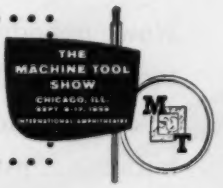
Here, automation is provided for loading and ejection of flywheel ring gears. The shuttle loader picks up a part from the magazine, moves forward, swings up 90° to place part into the clamps and returns for another part during the cutting cycle. After the cut, the clamps release allowing the part to roll down the unloading chute.

Free Data

Additional information is available on the complete line of Sundstrand Automatic Lathes for small lot, long run or special turning jobs. Ask for bulletin 158.

BOOTH

1412



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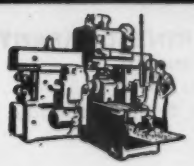

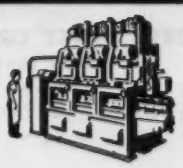

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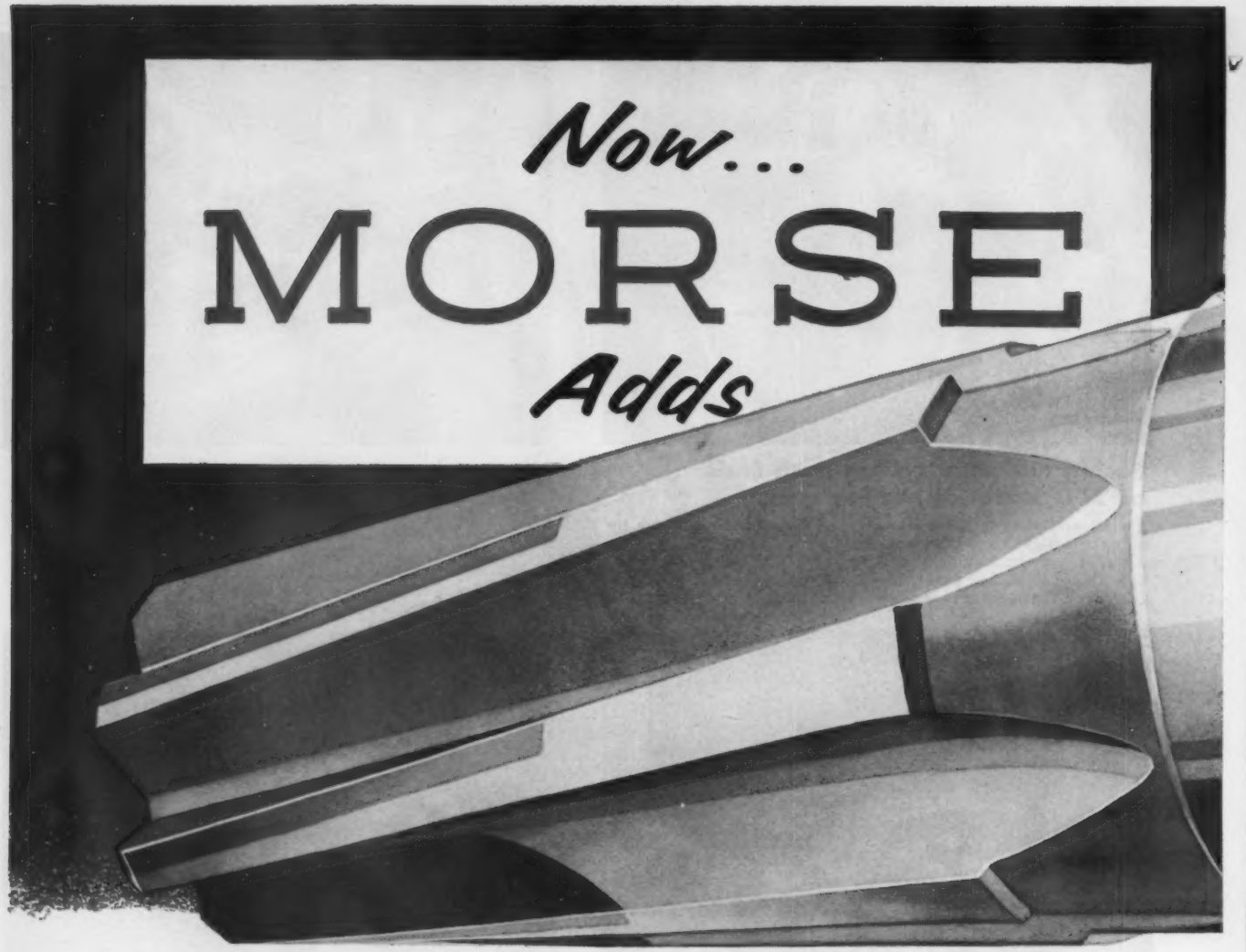
Machine Tool Co.
2533 Eleventh St. • Rockford, Ill., U.S.A.



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Now, nobody *but nobody* has a cutting tool line to match Morse in completeness . . . in productive capacity . . . in distribution . . . in engineering service . . . and in the ability to recommend without bias the best cutting tool for every job in your plant, *regardless of* tool requirements!!

This complete new line of Morse Tungsten Carbide Tools . . . both tipped and solid . . . conforms to Morse standards of quality and precision and is backed by years of experience in Carbide tooling. And, it will be available from your only source of Morse-cost-cutting tools . . . your Morse-Franchised Distributor.

So call him *now* . . . get the whole story in detail. It's the most interesting news that anyone in industry has heard since Stephen Morse invented the twist drill!

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CARBIDE TOOLS

(TIPPED AND SOLID)

Now...

MORSE

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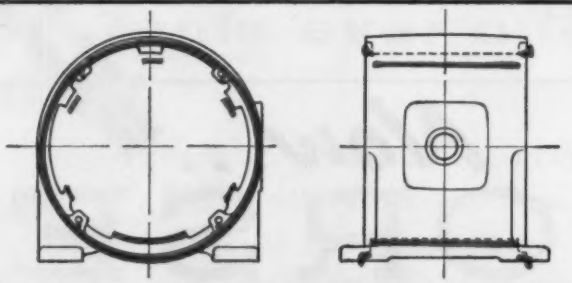
"THE MOST"

in Cutting Tools

PROBLEM

1. lower stator frame machining costs.
2. increase production and accuracy
3. run any one of four different size parts



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Drill 8 holes	Bore two inside diameters
Chamfer 8 holes	Rough face ends
Tap 8 holes	Remove chips

for problems in Drilling, Boring, Facing and Tapping

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cuts costs and increases production . . . and accuracy by combining operations!

SOLUTION

30 ESTIMATED GROSS PRODUCTION
PARTS PER HOUR
(ANY ONE OF FOUR DIFFERENT SIZE PARTS)

OPERATIONS

STATION No. 1
Load 1 part.

STATION No. 2
R. H. Horizontal Head
Combination rough bore for 10.492/10.490 half thru, rough bore for 12.064/-12.062 diameter, finish bore 10.520/10.510 diameter and rough face end.
L. H. Horizontal Head
Drill 4 holes

STATION No. 3
Idle

STATION No. 4
R. H. Horizontal Head
Drill 4 holes
L. H. Horizontal Head
Combination rough bore for 10.492/10.490 diameter rough bore for 12.064/12.-062 diameter and rough face end.

STATION No. 5
Idle

STATION No. 6
R. H. Horizontal Head
Tap 4 holes
L. H. Horizontal Head
Tap 4 holes

STATION No. 7
Idle

STATION No. 8
R. H. Horizontal Head
Idle
L. H. Horizontal Head
Finish bore to 10.492/10.490 diameter thru.

STATION No. 9
Blow chips out of center bore and 8 tapped holes (4 each side) and blow chips off top.

STATION No. 10
Unload 1 part. Part to be unloaded onto gravity conveyor.

NATIONAL AUTOMATIC TOOL COMPANY, INC.

RICHMOND, INDIANA

NATCO

BALANCED *Action* PERFORMANCE

Taps with these four craftsmanship-qualities will deliver it—All Winter Taps Have It

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is the first fundamental of Balanced Action. It is accomplished by precision indexing.

UNIFORMITY OF FLUTE CONTOURS

is essential, of course. You can't get Balanced Action without it.

PRECISION CHIP DRIVER CONTOURS

are exact to size, shape, and position—formed to give the finest performance.

ACCURATE AND CONCENTRIC CHAMFERS:

By holding shank, chamfer, and thread concentricity to very close limits, hole-accuracy is assured.

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plug and ring, thread and plain are made with "Balanced Action" accuracy

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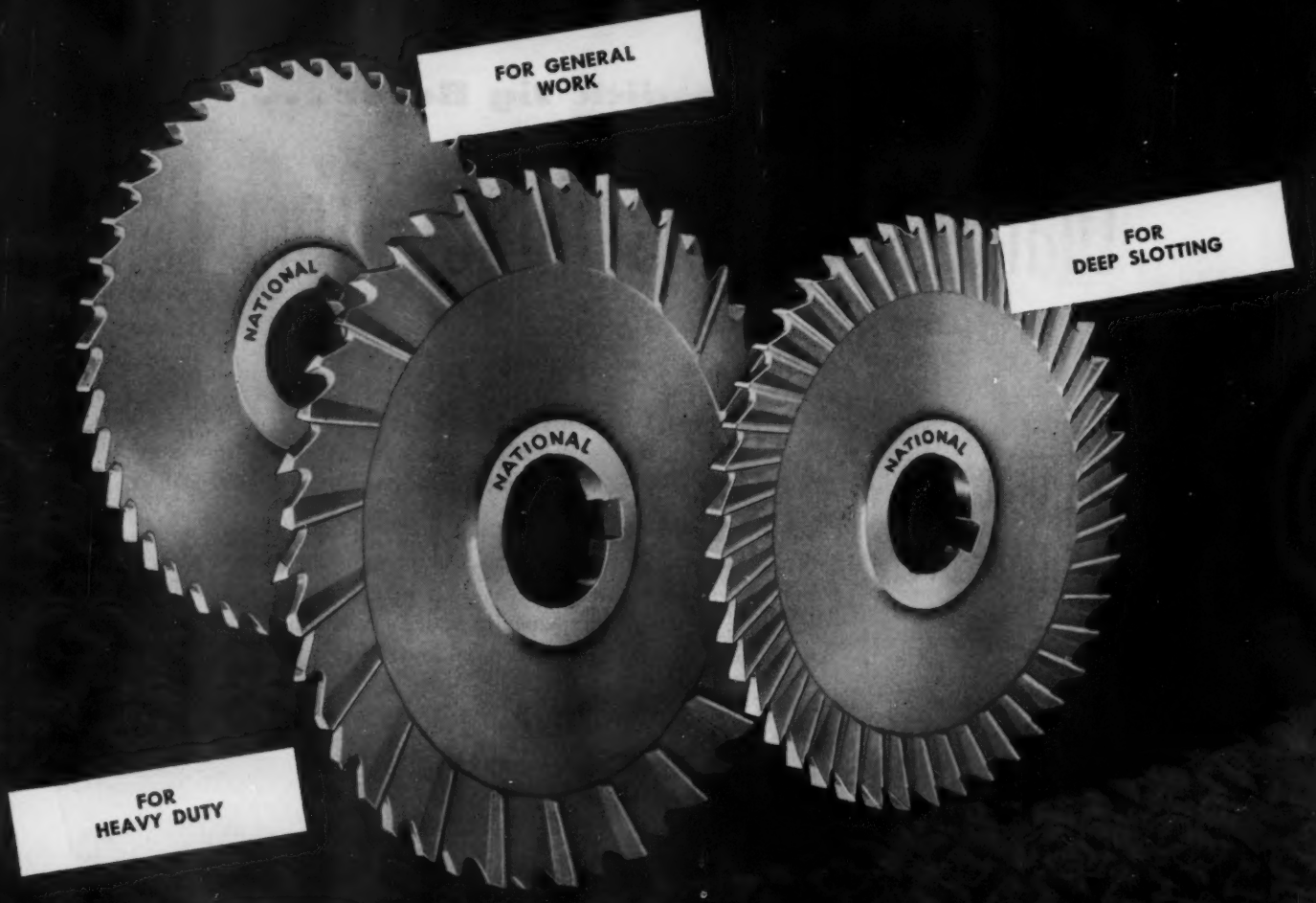

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The bite that's right for your sawing and slotting

Smooth. No binding, no scoring. Saws with National cutting edges do the job the way you want it done. Immediately available—a wide range of diameters and widths; also many special types of saws and slotting cutters.

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TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE TIPPED AND SPECIAL TOOLS

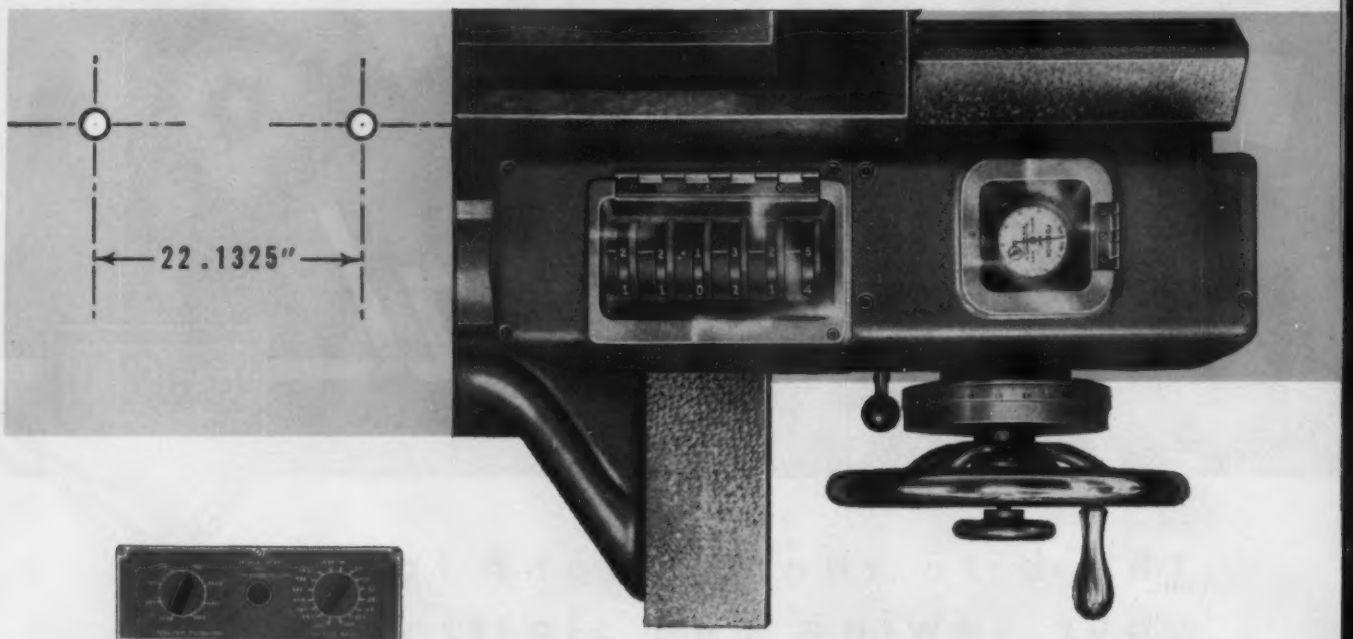
With the NEW Fosdick Jig Borer . . .

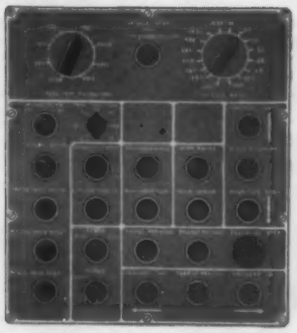
Dial Dimensions Direct from Print

This is DIRECT DIMENSION Measuring!

● This new and exclusive measuring system is the simplest, the most direct ever conceived for a jig borer! It will measure with precision to ± .0001". And the operator need not be highly skilled.

Dimensions from the blueprint are simply set on direct-reading drum dials, one for longitudinal, the other for transverse position. Easily-read numerical dials minimize errors. The finest Class 'A' gages . . . permanently sealed against dust and never handled by the operator . . . provide consistent precision.





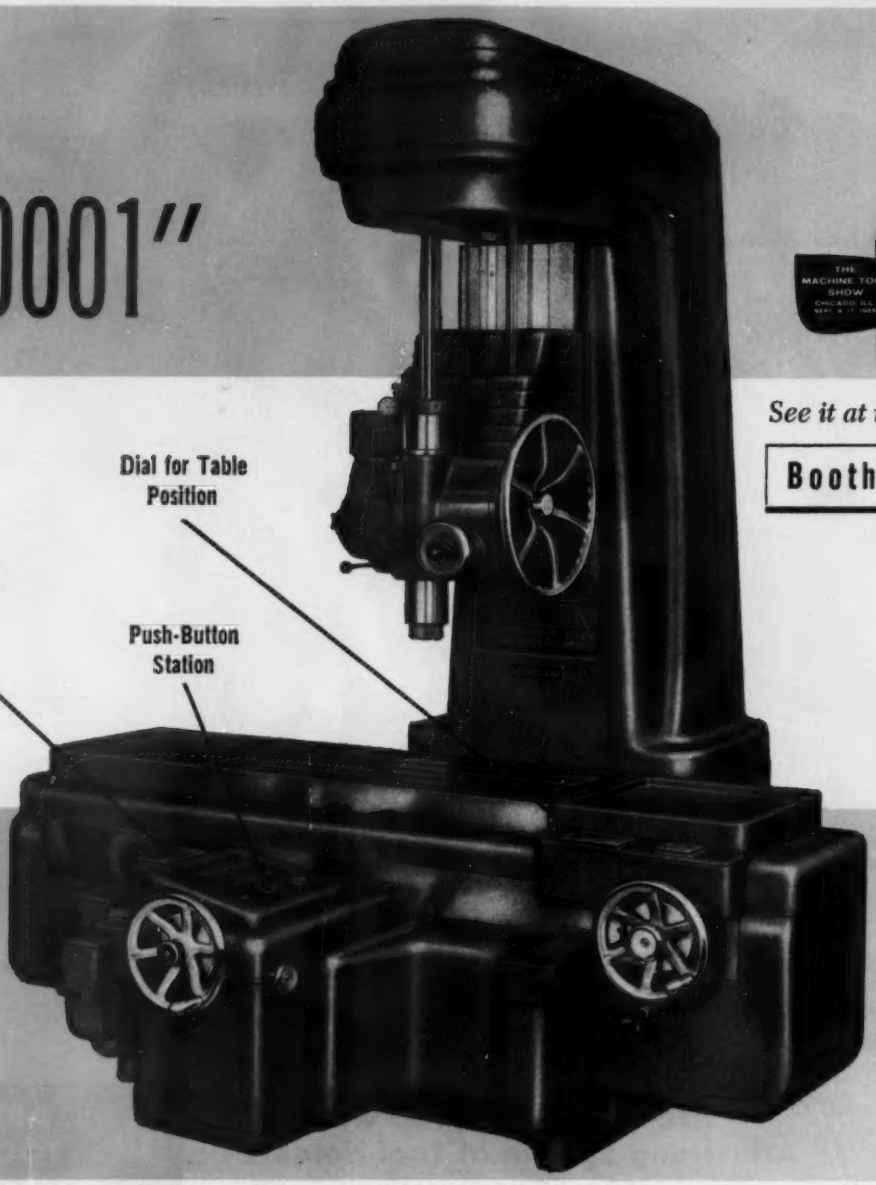
Press a Button . . . Table and Saddle Position Automatically!

Once dials are set, press the positioning button. Table and saddle will automatically position themselves to the dimensions set on the dials. We guarantee accuracy of ± .0001"!

In addition, push-button station controls spindle feeds and speeds; milling feeds to table and saddle; electric clamp to table and saddle; rapid traverse to table, saddle and quill; emergency stop.

NEED DRILLING EQUIPMENT? GET A PROPOSAL FROM FOSDICK!

...to .0001"



See it at the Show

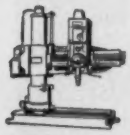
Booth 1402

Like the scores of Fosdick Jig Borers in plants throughout the U. S., this new machine will perform consistently to ± .0001" . . . in measured table and saddle position as well as hole size. In addition, a new degree of speed and convenience has been attained in our exclusive Direct Dimension measuring system.

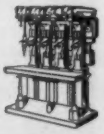
Other major advancements in this machine contribute to a long life of consistent precision performance. Our new quill bearing design locates ball races permanently at top and bottom of head, regardless of quill position. Gears are hardened and ground and are operated by magnetic clutches.

Other features include – 16 spindle speeds and 8 feeds, both *preselected* from push-button station. Rapid Traverse to head with electric clamping. Rapid traverse to quill (extra). Electronically-controlled milling feeds from ¾" to 15" per minute. Table sizes – 22" x 44", 22" x 54".

Write today for bulletin containing full description.


Radial Drills

Jig Borers


Sensitive and Upright Drills

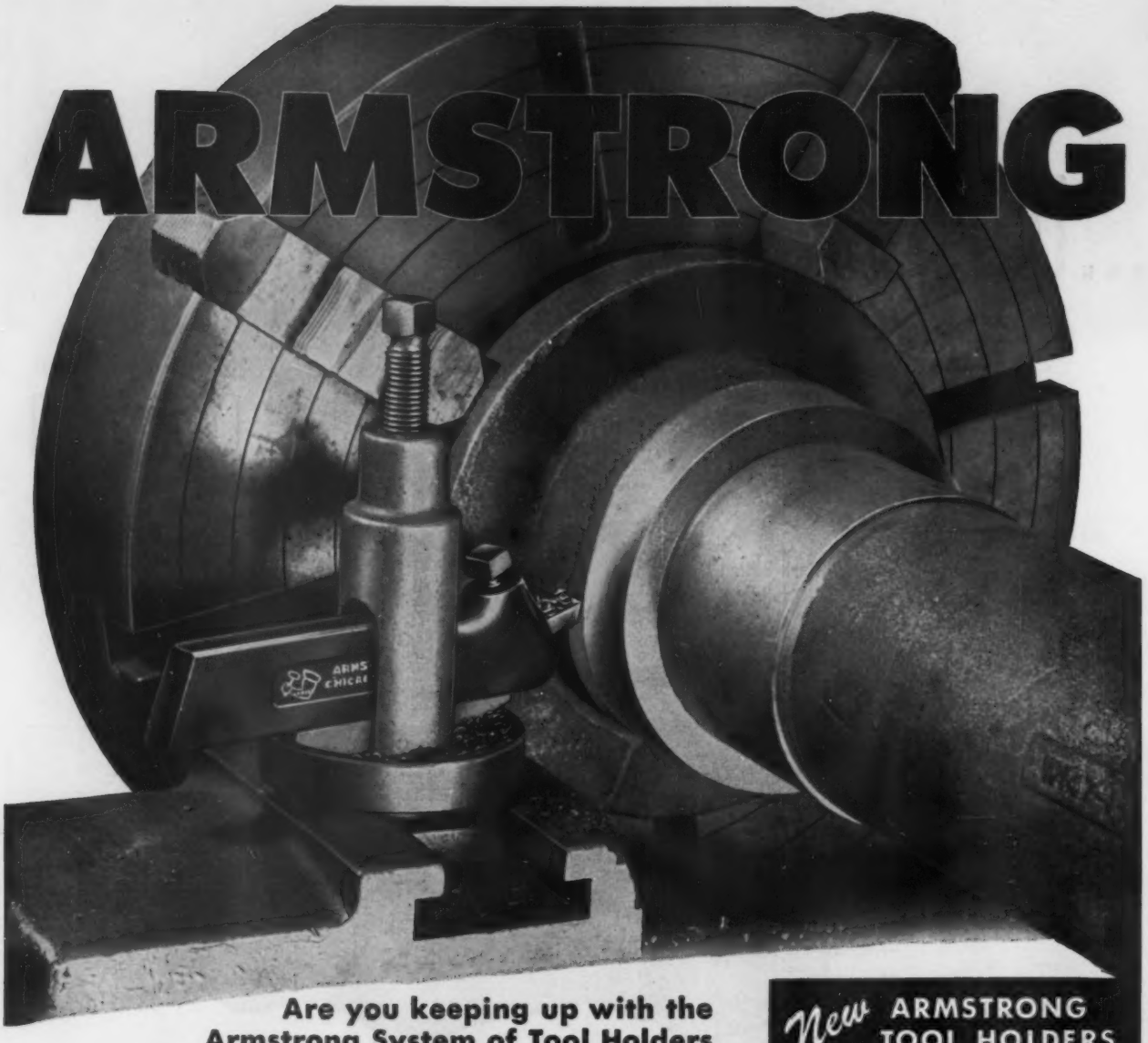
Sensitive Radial Drills

Automatic Positioning Machines

FOSDICK

THE FOSDICK MACHINE TOOL CO., CINCINNATI 23, OHIO

ARMSTRONG



Are you keeping up with the Armstrong System of Tool Holders

Doubtless you are daily using ARMSTRONG TOOL HOLDERS that have been in continuous operation for many years. This is sound practice, for this means added profits without added tool costs. But to become complacent, so satisfied that you forget your ARMSTRONG TOOL HOLDERS, is unwise. The "Armstrong System" is a growing thing, with new types and sizes of ARMSTRONG TOOL HOLDERS constantly being developed to more effectively meet new machining conditions, or to take advantage of newly developed cutting materials.

With modern ARMSTRONG TOOL HOLDERS for each operation, you can greatly increase speeds and feeds. You can lower machining cost and further increase profits.

If you haven't kept up with the "Armstrong System" write for an ARMSTRONG Catalog and check to see that you are using the most efficient ARMSTRONG TOOL HOLDER for each operation on all lathes, planers, slotters and shapers.

WRITE FOR CATALOG

New ARMSTRONG TOOL HOLDERS
ARMSTRONG Spring Form Threading Tool Holder
ARMSTRONG Spring Cutting-off Tools
ARMSTRONG Carbide Tool Holders for Carbide-Tipped Cutters
ARMSTRONG "C-A" Tool Holders for ARMALOY (Cast-Alloy) Cutter-Bits

See us at Booth #550 Metalworking Machinery & Equipment Exposition Chicago Coliseum, Sept. 6-17

ARMSTRONG BROS. TOOL CO. *"The Tool Holder People"* 5215 W. ARMSTRONG AVENUE CHICAGO 30, ILL.

A light touch

FOR HEAVY PRODUCTION

New concepts of hydraulic headstock design permit a blending of operator skill and machine response never before achieved . . . all resulting in effective use of a wider choice of speeds and extra heavy duty metal cutting capacity.

THE WARNER & SWASEY COMPANY • CLEVELAND 3, OHIO

SEE

DOWN • TO • EARTH

SHOP JOBS

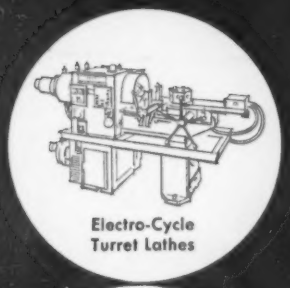
AT 717

THE MACHINE TOOL SHOW
CHICAGO, ILL.
SEPT. 6-17, 1955
INTERNATIONAL AMPHITHEATRE

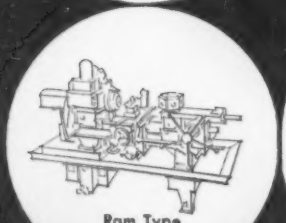
Machine designs change, but practically all these changes are made to improve methods for machining jobs such as you have in your own plant right now!

That's what we believe you want to see at the Machine Tool Show—better methods for doing your work. And that's exactly what you'll see at the Warner & Swasey booth . . . the most modern machines, utilizing the latest production techniques, turning out typical shop jobs.

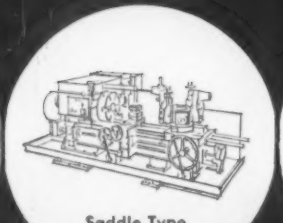
We believe you will take home an important "souvenir" of your visit to Booth 717 . . . ideas on how you can machine metal more efficiently, more profitably!



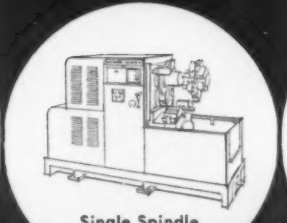
Electro-Cycle Turret Lathes



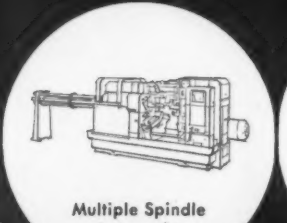
Ram Type Turret Lathes



Saddle Type Turret Lathes



Single Spindle Automatics



Multiple Spindle Automatics

Precision Tapping Machines

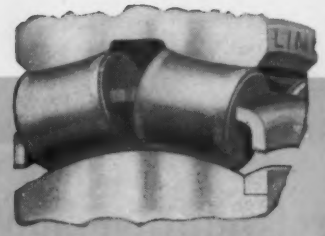
75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

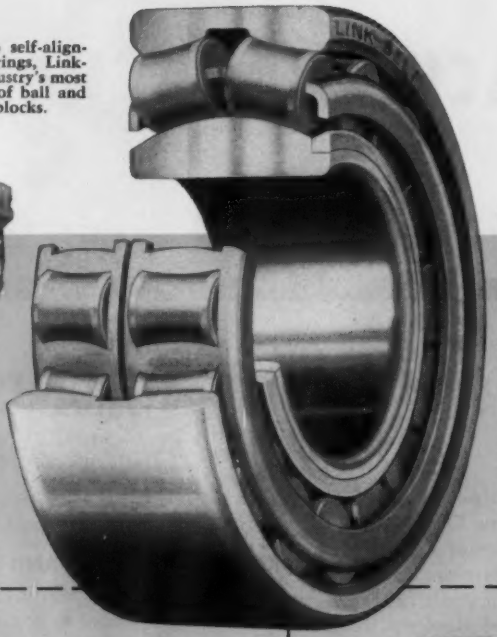
NO MATTER WHICH WAY YOU TURN...
WARNER & SWASEY CUTS COSTS

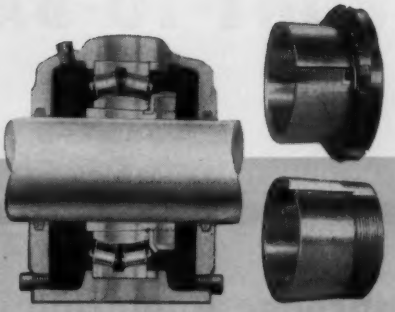
For tough, heavy-duty applications...make use of these important

bearing differences

In addition to self-aligning roller bearings, Link-Belt makes industry's most complete line of ball and roller bearing blocks.





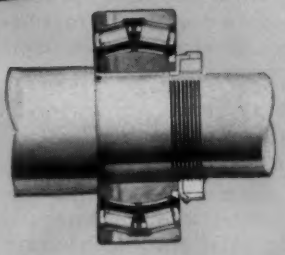


FREE ROLLING—SELF-ALIGNING. Rollers are naturally positioned by their concave shape. Design assures true rolling under all conditions. Spherical inner ring can be aligned in any direction without affecting load capacity.

EASY INSTALLATION and removal of adapter type bearings are provided by the tapered fit of bearing on adapter sleeve which is readily adaptable to commercial shafting tolerances. Locknut draws sleeve tightly around shaft for positive, concentric mounting. Lockwasher holds locknut in place.

LOCKED-IN CLEARANCE. Selective assembly of rollers and raceways with accurately formed hardened steel retainers assures proper operating clearance, guidance and spacing of rollers.

Rollers are completely pocketed in retainers for accurate spacing and guiding.



SMOOTH OPERATION, LONG LIFE are advantages of the straight bore type mounting, which assures maximum concentricity of inner ring with shaft. Especially desirable when minimum radial run-out is essential.

They're all present only in LINK-BELT self-aligning roller bearings

SUBTLE differences in bearings can make notable differences in the life and efficiency of your equipment. Take Link-Belt self-aligning roller bearings, for example. Their "self-contained" feature permits the bearing to float axially in the mounting, when desired, compensating for shaft expansion or settling of bearing supports . . . preventing extraneous thrust loads from being set up between bearings on the same shaft. What's more, inherent self-aligning design and preadjustment preclude use of expensive or cumbersome self-aligning housings.

Ask your nearest Link-Belt office or authorized stock-carrying distributor for Book 2196 on self-aligning roller bearings and Book 2550, containing full data on all Link-Belt ball and roller bearings.

LINK-BELT

Ball and Roller Bearings

LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World. 13.711-A

NEW

FRONT-TO-BACK CRANKSHAFT DESIGN

embraces numerous operating and structural improvements

Of far reaching importance, the development of Niagara's impressive, new Styleline Deep Throat Presses has opened the way to numerous operating and structural advantages. Barriers imposed by conventional side-to-side crankshaft arrangements and outmoded end wheel designs have been shattered. The Niagara-developed front-to-back crankshaft design introduces a new concept of deep throat press performance and economics:

MODERN, SPACE-SAVING, ENCLOSED CONSTRUCTION

The entire driving mechanism is within the limits of a compact, all-steel frame. There are no exposed, overhanging parts and mechanisms to obstruct crane service, block light, throw grease and consume floor space unnecessarily.

LONGER DIE LIFE, GREATER ACCURACY

Increased distance between gibs makes possible a wider slide (left to right) for greater support to wide dies. Longer gibs assure accuracy for the full stroke.

MINIMIZED SHAFT DEFLECTION AND GEAR WEAR

With all gears located inside the press frame and overhung bearings eliminated, damaging shaft deflection is held to a new minimum. Both pinion and gear are more rigidly supported to withstand maximum loading with minimum wear.

PROLONGED GEAR AND CLUTCH LIFE

Gears and clutch members, all neatly housed in the crown, operate in sealed baths of oil to assure longer service life.

Built in a large range of sizes and throat depths, these modern, Styleline Series C Presses reflect the latest thinking of Niagara engineers . . . today as always, pace-setters in power press advancement.

HERE'S THE WHOLE STORY ON WHAT THESE MACHINES CAN DO FOR YOU

Get all of the facts. Check the specs! Write for new, illustrated Bulletin 61 today. It will be mailed promptly without obligation.

NIAGARA MACHINE & TOOL WORKS • BUFFALO 11, N. Y.

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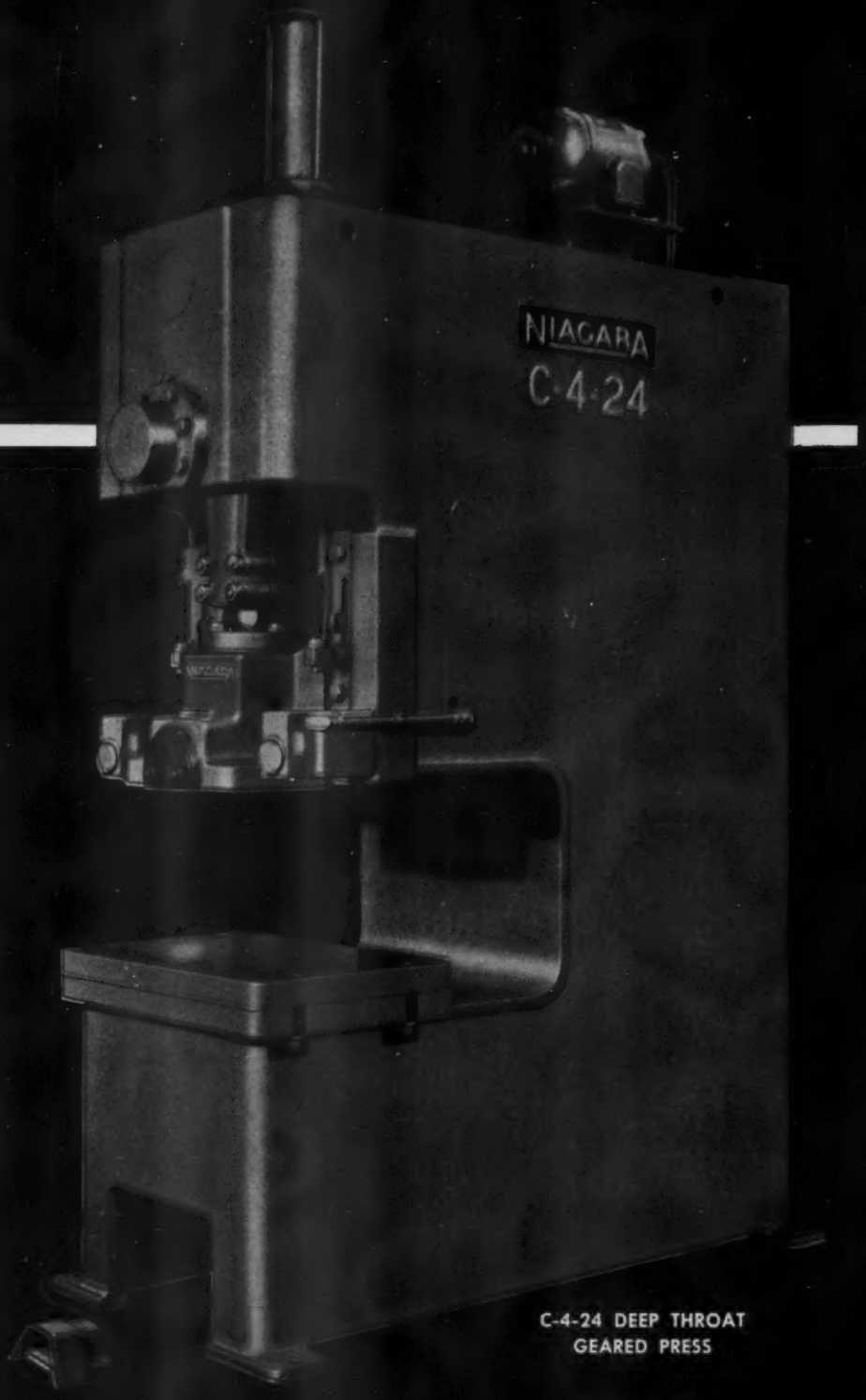
NIAGARA

America's Most Complete Line of Presses, Shears, Machines and Tools for Plate and Sheet Metal Work



C-4-24 DEEP THROAT
GEARED PRESS

Air counterbalance offsets weight of slide, die and connections.

No overhanging motor, belts, flywheel, brake, shafts nor other mechanisms.

Front-to-back crankshaft (heavy, forged, high carbon steel) enables fully stylelined, enclosed construction.

Multiple V-Gibs assure maximum die life.

Unusually long slide and stiff channel section eliminate deflection of guiding ways, increasing die life. (J.I.C. flanged slides available.)

Large range of throat depths accommodates tremendous variety of work.

Rugged, all-steel, box type frames stress relieved in a furnace and grit blasted before machining.

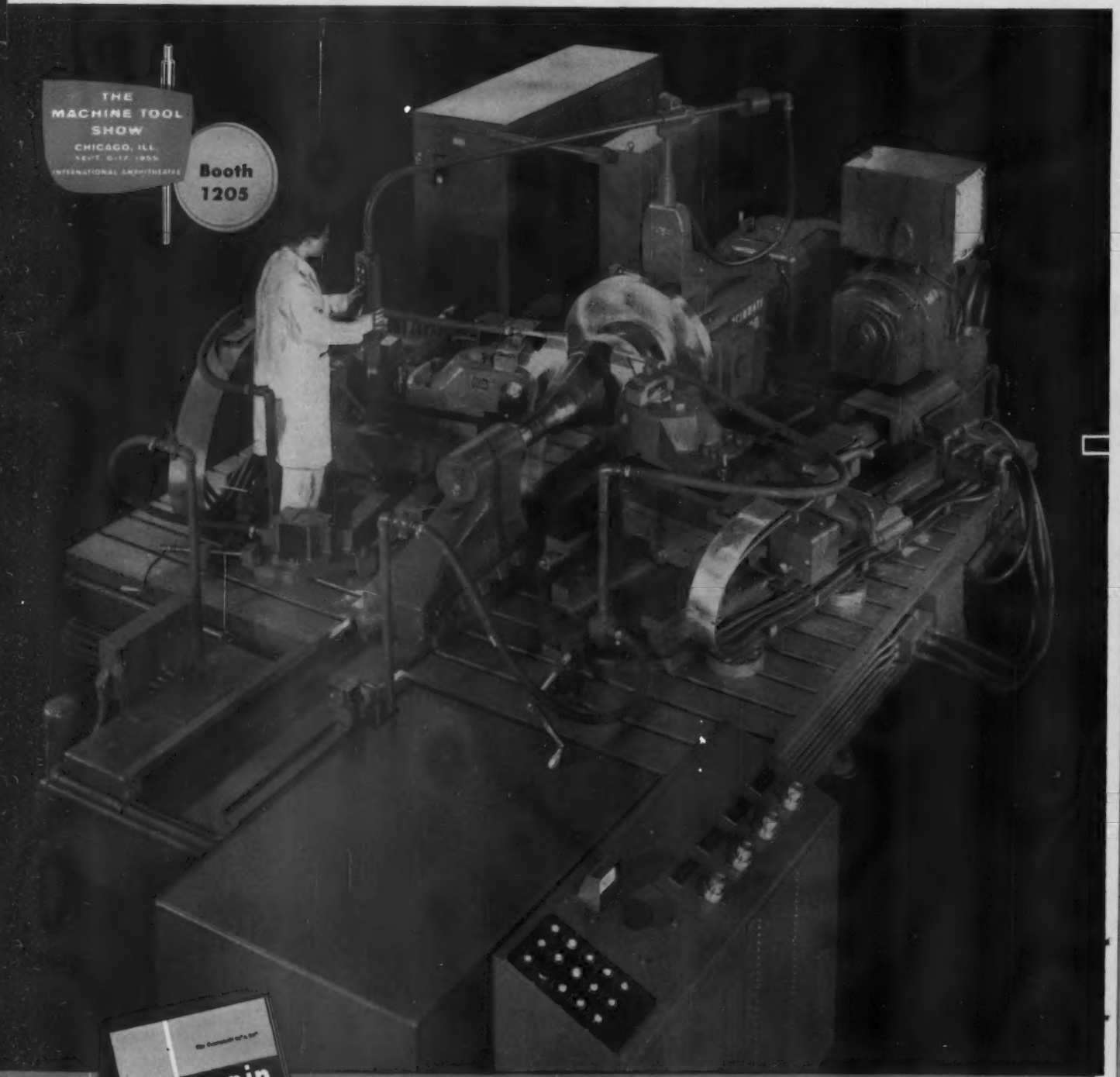
Foot switch optionally available for clutch control.

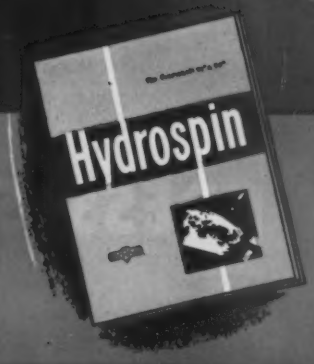
Readily equipped with pneumatic die cushions for drawing operations.

Exclusive electro-pneumatic clutch on all geared models. Famous mechanical sleeve clutch on all plain, non-geared models.

STYLELINE DEEP THROAT PRESSES

"CHIPLESS MACHINING" by





Write for the new Hydrospin Bulletin No. M-1873-1.

CINCINNATI 42" x 50" HYDROSPIN — Full bed design. Parts up to 42" OD and 50" long can be produced. Also available in 42" x 50" Half Bed design (one roller slide assembly). Hydraulic contour tracing attachment, turning and mandrel grinding attachments and carriers for end-mounted rollers also available.

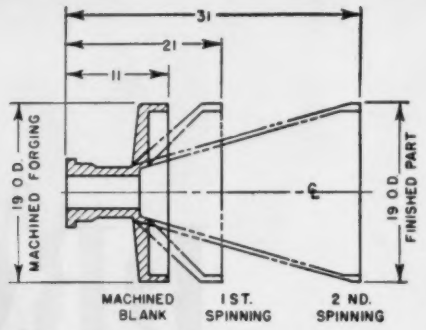
the NEW Cincinnati Hydrospin

cuts costs 1/2 to 4/5 on expensive-to-shape parts

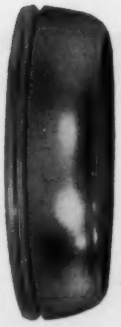
HYDROSPINNING is The Cincinnati Milling Machine Co. process for *roll-flowing* ductile metals into a wide variety of shapes having circular cross-section. A metal blank—sheet, plate, pre-formed cup, casting or forging—is caused to flow longitudinally along a rotating mandrel. Hydraulically powered rollers, capable of applying pressures up to 400,000 psi, force the metal against the mandrel to generate the desired part shape, such as those shown at right.

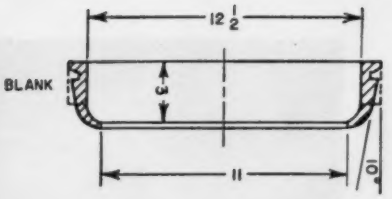
Parts are quickly produced, normally in one pass of the rollers. Wall thickness—straight, curved and tapered sections—can be held to tolerances as close as ±.004". The metal, having undergone a severe shear deformation, possesses increased strength, hardness and resistance to fatigue. In many instances, less costly materials have been successfully substituted for alloyed stock and heat-treating operations have been eliminated. Subsequent machining operations are usually limited to light cuts in areas that cannot be spun.

Savings on part production costs running as high as 50%—80% are now being made with the Cincinnati Hydrospin. *Can you also profit?* For detailed information, contact the Cincinnati Milling field engineer in your area.

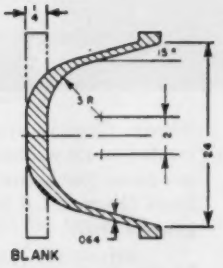


Turbine shaft, Hydrospun from premachined AISI 4340 alloy steel forging, in two operations.





Hood, Hydrospun from rolled and Heliarc-welded ring of type 321 stainless steel, in two operations. First roller plunge-formed groove. Second, tracer-controlled roller thinned and closed tapered wall.

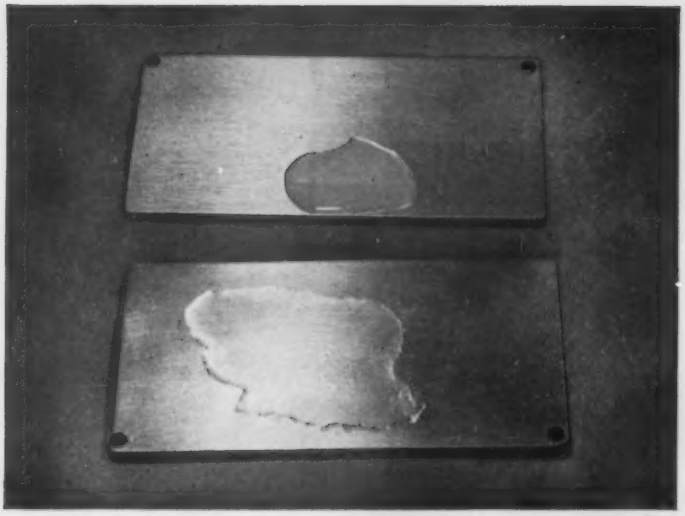


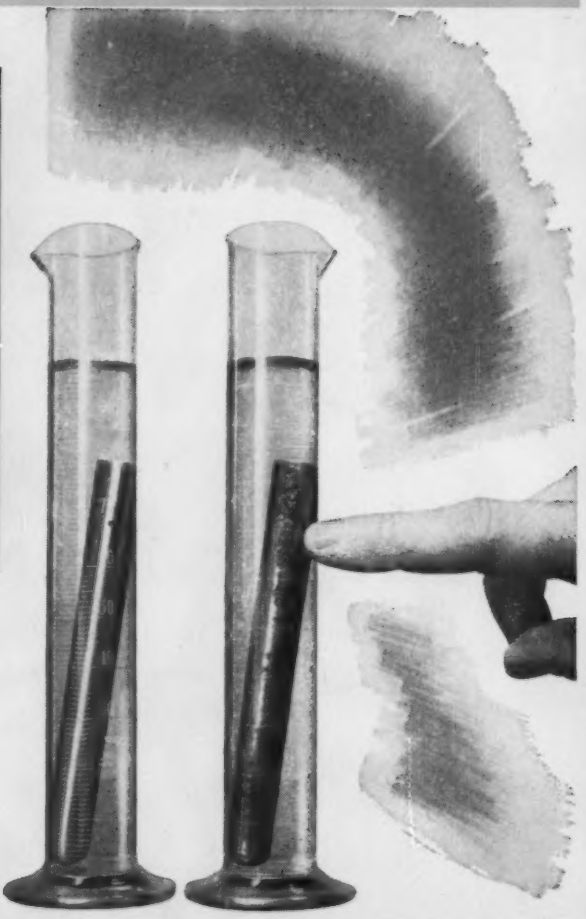
Bullet-nose shell, Hydrospun in one operation from ¼" thick C-1020 hot rolled steel plate, using tracer-controlled roller.

CINCINNATI **Hydrospin**

PROCESS MACHINERY DIVISION
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO, U. S. A.

Announcing
SHELL
DROMUS OIL E





Above: Cooling action of a cutting fluid is directly related to its wetting ability. Conventional soluble oil emulsion (background) "balls" up. Equal amount of Shell Dromus Oil E spreads out thinly . . . wets far greater area.

Right: Plain carbon steel, if left in water at room temperature for about two hours, will rust as shown. Sample on left was in a 1-30 solution of Shell Dromus Oil E and water *for six months without rusting.*

SHELL DROMUS OIL E

NEW CUTTING OIL

permits higher speeds and faster feeds than ever maintained before

Shell Dromus Oil E, a new solution-type fluid, wets all metal surfaces with extreme rapidity and keeps both work and tools exceptionally cool. These qualities permit an increase of machine speeds and/or feeds far beyond anything allowable with conventional soluble oils.

IT'S MUCH EASIER ON TOOLS

There's much more life in any cutter or abrasive wheel when protected by this new oil. *It stays put* between tool and work. (At a 1-30 dilution, average tool life increase in extended field tests was about 50%.)

IT FIGHTS RUST

Shell Dromus Oil E is readily soluble in hot, cold, soft or hard water, and stable in any concentration. Even at low concentrations, it gives excellent rust protection to all ferrous metals, *including cast iron.*

IT KEEPS WORK COOL

Even at stepped-up production rates, you'll find less heating and better finish wherever this new oil is used.

IT SETTLES OUT FAST

Chips and wheel particles settle out immediately . . . the recirculated fluid is clean and free from contaminating particles. It is *not* sticky or greasy . . . leaves no deposits on machines or work.

IT'S GREAT FOR GRINDING

Grinding wheels remain clean, *even when material retains a film of cutting oil from a previous operation.* Even cast iron can be ground cleanly when Shell Dromus Oil E is used to cool the work.

If all this reads "too good to be true," we suggest that you try Shell Dromus Oil E *on any problem operation you have.* It *is* that good!

SHELL OIL COMPANY

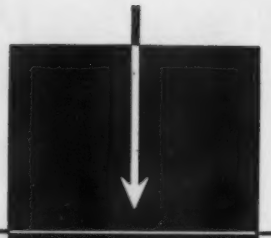
50 West 50th Street, New York 20, New York
100 Bush Street, San Francisco 6, California

SHELL

NUMBER TWO IN A SERIES

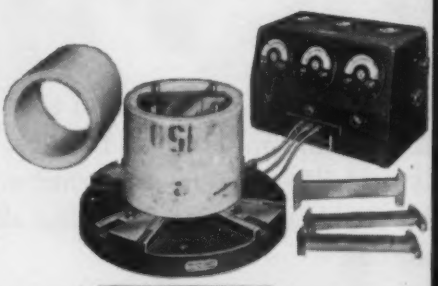
What's The Best Way To Gage These Parts ?

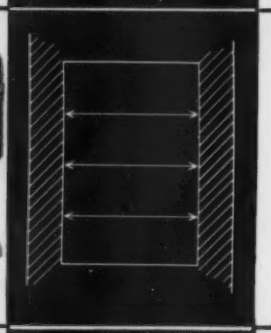
Tips from Taft-Peirce on when and where to use a T-P CompAIRator Air Gage



Three ID's
Tolerance: .120″

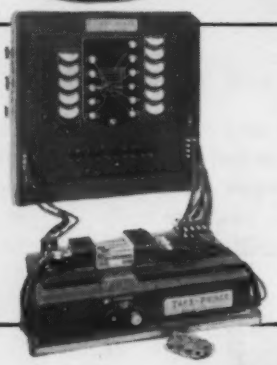
One three dial T-P CompAIRator Air Gage checks three ID's simultaneously on this asbestos cylinder. Only a T-P CompAIRator can check such wide tolerances. Versatile as well as sensitive, T-P CompAIRator equipment may be designed to check most any specific tolerance range from .0001″ to .125″. And most any dimension from simple ID's and OD's to complex tapers, barrel shapes, squareness or ovality.

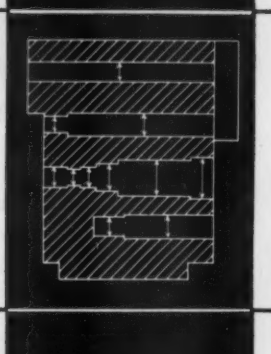




Eleven ID's
Tolerance: .001″

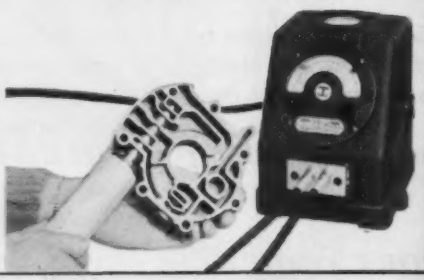
One eleven dial T-P Air Electric CompAIRator reduces inspection of 11 ID's on this valve body to a fraction of a second. Lights indicate any dimensions out of tolerance. Dials give exact readings of size. Savings in time alone paid for this unit in short order. Vibration, jarring, tilting won't disturb its accuracy.

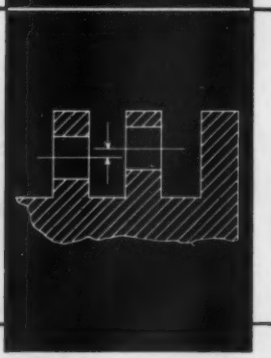




Concentricity
Tolerance: .0002″

This T-P Computing CompAIRator indicates on one dial the total eccentricity between two diameters. Saves multiple measurements and a computation. An exclusive T-P development, Computing CompAIRators may also be used to speed and simplify such checks as center distance, taper, and squareness of bore-to-face.





For more examples and the complete story on Taft-Peirce CompAIRator Air Gages send for Bulletin.

WHAT IS A COMPAIRATOR AIR GAGE?

A CompAIRator is a sensitive gaging instrument that measures variations in the velocity of tiny jets of air. When work is placed over these jets, air flow is restricted and its velocity reduced. Any change in air velocity reflects a change in part size, which is immediately shown on a calibrated indicator. Since only air contacts the part in most cases, there is minimum wear on gaging members. Fast, accurate, dependable, a T-P CompAIRator is simple to operate, requires little or no maintenance.

STANDARD AND SPECIAL COMPAIRATORS | COMPUTING COMPAIRATORS | AUTOMATIC SORTING MACHINE | AIR ELECTRIC COMPAIRATORS

T-P means Top Precision

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

LE BLOND of Cincinnati AT THE SHOW

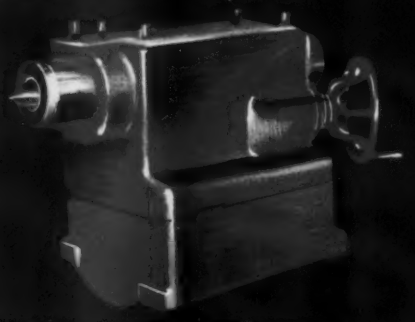
NEW 16" APRON

NEW 15" DUAL DRIVE

50" ROLL TURNING LATHE

NEW 32" SPINDLE

NEW HEAVY DUTY BED

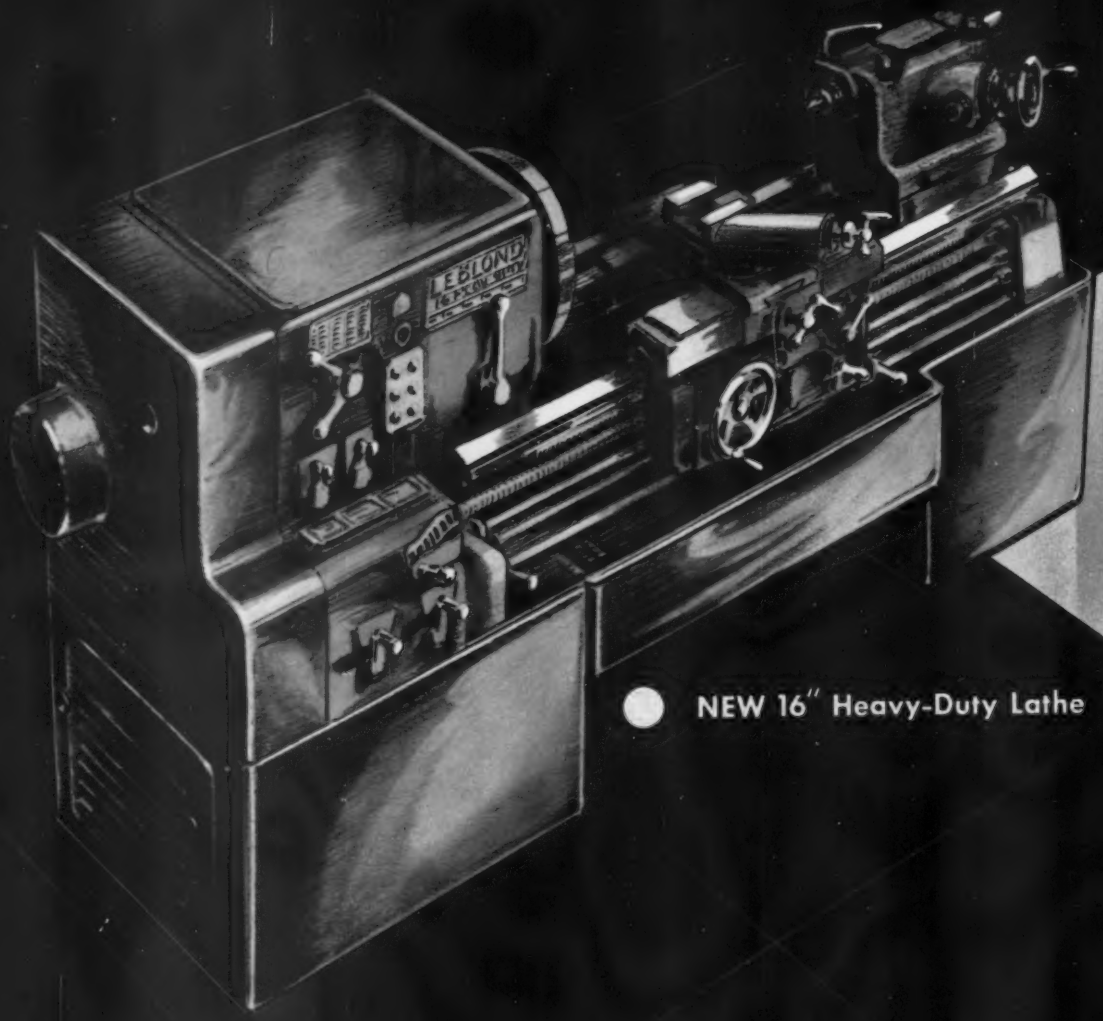


NEW HEAVY DUTY TAILSTOCK

NEW 13" REGAL

Turn the page for a preview

NEW 15" Regal Lathe



NEW 16" Heavy-Duty Lathe

NEW 15" Dual Drive Lathe

CUT WITH CONFIDENCE... WITH THESE NEW LeBLONDS

13", 15", 17" and 19" Regals

Designed and built like heavy-duty lathes, the new LeBlond Regals offer a long life of precision production, minimum maintenance and true big-lathe dependability! New headstock uses proven gear-belt drive design. New bed has replaceable hardened and ground steel ways. Other big-lathe features—Separate feed rod and leadscrew. 3-bearing spindle. Automatically-lubricated quick-change box. Many more. *Ask for Bulletin R-200S.*

15" Dual Drive

For medium-duty performance at low cost, the new LeBlond Dual Drive is number one! With a single lever you get 16 spindle speeds from 30 to 2400 rpm. The headstock is of combination gear-belt drive design with a 3-bearing spindle. Motor is 5 hp., 1800 rpm. Quick-change box is totally-enclosed. Replaceable hardened and ground steel ways are fitted to the compensating veeway principle for the best distribution of forces. *Ask for Bulletin 6S.*

16" Heavy Duty

Completely redesigned from top to bottom, our new 16" is the most advanced heavy duty in the business! The combination gear-belt drive headstock provides 27 spindle speeds. The center spindle bearing is supported in the new Timken "semi-flexible mounting" for precise support throughout the speed range. Four-way power rapid traverse. 20 hp. Totally-enclosed quick-change box. Replaceable hardened and ground steel bed ways. *Ask for Bulletin HD126S.*

LeBLOND of Cincinnati AT THE SHOW

We are extremely proud of the major design advancements you'll see at the LeBlond Exhibit—No. 1313, dead center in the new Exhibition Hall. You'll see 16 of the world's most modern lathes. You'll witness unique demonstrations in tracing, rapid boring and high-power turning. *Don't miss LeBlond!*

NEW 13", 15", 17" and 19" Regal Lathes

Famous for dependable performance at low cost, our Regals have been redesigned from the ground up! Biglathe features include — Combined gear and belt-drive headstock. Replaceable hardened steel bedways. Separate feedrod and leadscrew.

NEW 15" Dual Drive Lathe

Best buy in the medium-duty class, the new Dual Drive features 16 speeds from 30 to 2400 rpm through a combined gear and belt-drive headstock. 5 hp. Replaceable hardened steel bedways. Totally-enclosed quick change box.

NEW 16" Heavy Duty Lathe

Most popular of the heavy duties, our new 16" provides 27 speeds from 16 to 2000 rpm through a combined gear and belt-drive headstock. 20 hp. Four way power rapid traverse. Replaceable hardened steel bedways. Enclosed quick change box.

RT Toolroom Lathe

Even today, other lathes can't match the advanced designs pioneered by LeBlond in the RT. Universal QC box—90 feeds and threads. Automatic chasing stop. Combined feed apron with built-in taper attachment.

NEW 25" and 32" Heavy-Duty Lathes

Cut with confidence at high horsepower! New headstocks use heavy, short shafts; 4-bearing spindle; provide adjustable accelerations for starting, stopping, jogging. 50 hp on the 25", 60 hp on the 32".

NEW 32" Special Heavy-Duty Lathe

You'll see well over 100 hp actually used at the tool. Built for Carboloy to test the newest in carbide tooling, this special 32" uses a 125 hp, variable speed drive, provides speeds from 42 to 1400 rpm.

NEW 25"/50" Sliding Bed Gap Lathe

A brand new model of this most versatile of lathe designs. Headstock provides 36 spindle speeds from 6 to 625 rpm. Adjustable acceleration for starting, stopping, jogging. New bed increases stability, easy cleanout.

50" Roll Turning Lathe

See how huge steel mill rolls are contoured in less than half former time. Two-directional hydraulic tracing from a simple template. Feed and speed can be varied during cut without leaving a tool mark.

NEW Automatic Crankshaft Lathe

Fifty-five crankshafts per hour are turned on the fastest crank-turning equipment yet developed. Five main bearings, flange and pilot, sprocket diameter and front end turned simultaneously. Transfer is automatic.

NEW LeBlond-Carlstedt Rapid Borer

Entirely new concept in high production of deep holes. Designed expressly to accommodate the new boring method and tooling developed in Europe. Don't miss this demonstration — *see holes bored 3 to 8 times faster than ever before!*

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY

CINCINNATI 8, OHIO

LeBLOND of Cincinnati

World's Largest Builder of a Complete Line of Lathes . . . For More than 68 Years

Turn the page for a preview

Litho in U. S. A.

Slow-moving shipments kept Joe in a pickle,
His sour disposition nothing could tickle . . .

But now he's all sweetness—the light just broke through.
Could swift **RAILWAY EXPRESS** be your answer, too?

The big difference is

Whether you're sending or receiving, whether your shipment is big or small, and whether it's moving by rail or air—you'll find it pays to specify Railway Express. It makes the big difference in speed, economy, and safe, sure delivery.

• • •

Railway Express uses the facilities of some 480 independent and competitive transportation companies in the movement of express traffic. It's free enterprise at its best, putting at your service one-third of a million miles of co-ordinated rail, air, water, and truck routes that connect all America.

RAILWAY EXPRESS AGENCY

. . . safe, swift, sure

ALL NEW

Lodge & Shipley

10" Hi-Turn LATHE

PERFECTED FOR PRODUCTION!

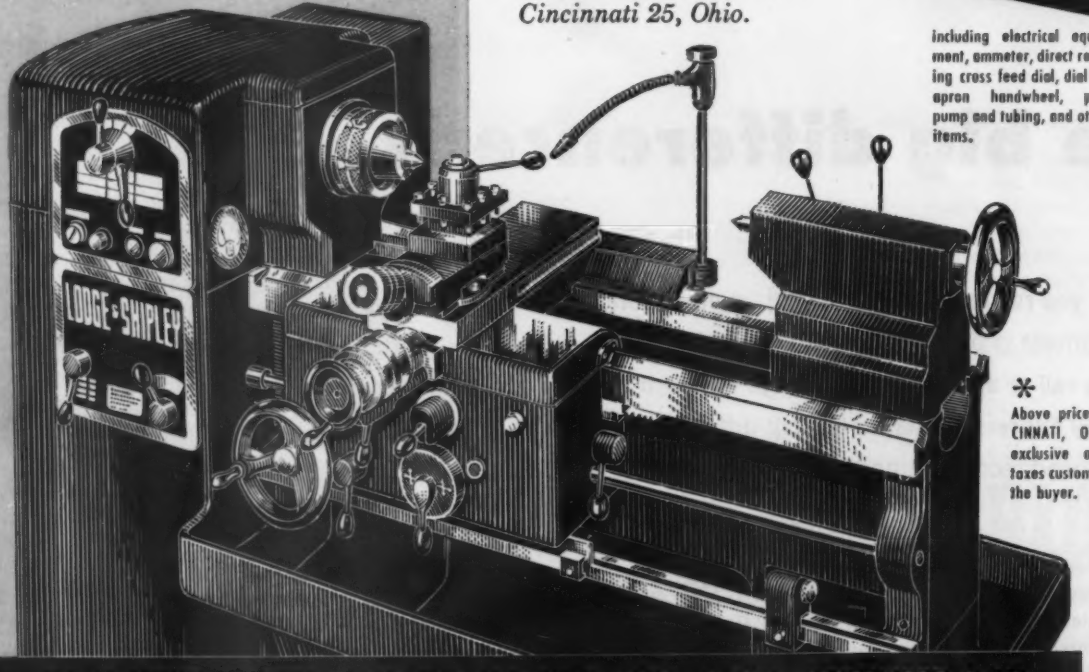
... never before ... so many features ...
so much quality ... at such low cost!

- 9 color-coded speeds up to 3000 RPM and 5 HP
- Totally enclosed quick change gear box
- Dynamically braked motor in leg
- Template-type length stops, magnetic clutch operated
- Flame-hardened replaceable steel bedways
- Hardened and ground cross slide ways
- Direct reading cross feed and top slide dials
- Provision for rear tool block and multiple tools

The Lodge & Shipley 10" HI-TURN Lathe is a completely new concept in lathes. Establishing that lathes for high speed production rarely utilized leadscrews, Lodge & Shipley eliminated the leadscrew and its complicated gearing ... added other features for high production and accuracy at low cost. The result is a rugged lathe of high efficiency at a price substantially lower than conventional lathes.

Write for detailed Bulletin 300, The Lodge & Shipley Co., 3055 Colerain Avenue, Cincinnati 25, Ohio.

only **$4,985*** including electrical equipment, ammeter, direct reading cross feed dial, dial for apron handwheel, pan, pump and tubing, and other items.



* Above price is FOB CINCINNATI, OHIO and is exclusive of applicable taxes customarily paid by the buyer.

SEE IT NOW! and SEE IT AT THE MACHINE TOOL SHOW, SEPTEMBER 6-17

the class leader

...and with high speed steels

REX is first in its class

Outstanding achievement! That's the only way a product can earn the reputation of being "first in its class." And REX®, as the recognized leader in high speed steels, is no exception.

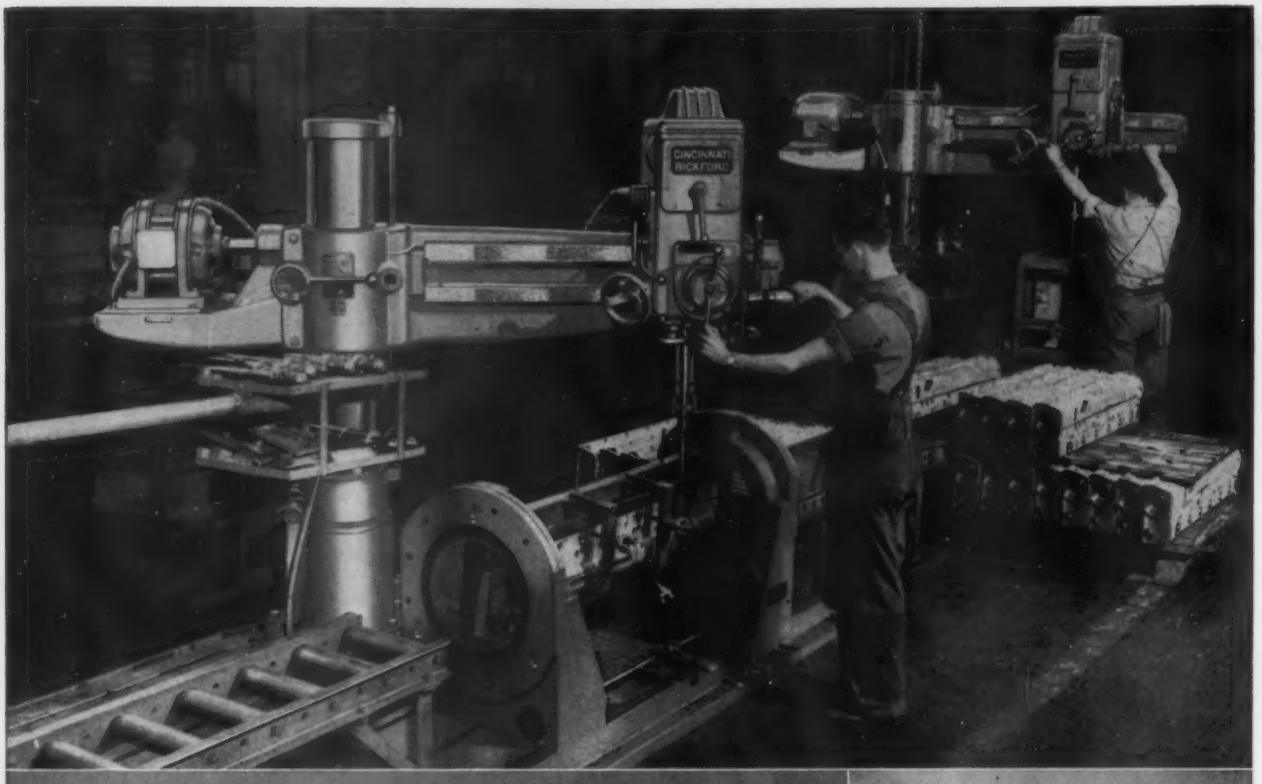
In thousands of tool shops... in every type of application – Crucible REX high speed steels have proved their superiority for over half a century. But it's performance in *your* shop that counts! Try REX on your next job. Test it for size, structure, response to heat treatment, fine tool performance. And you, too, will say REX is *first in its class.*

REX is made only by Crucible. It's available immediately from local Crucible warehouses... or by prompt mill delivery. To find out about REX and the many other types of Crucible special purpose steels, write today for "Crucible Publication Catalog." *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

Visit us at Booths 830-832 Production Engineering Show, September 6-16, Navy Pier, Chicago.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America



3 years of operation with NO MAJOR MAINTENANCE . . .

Photos courtesy Caterpillar Tractor Co., Peoria, Illinois.

Camshaft Housings for new Caterpillar DW21 Wheel-type Tractor illustrated in insert picture, showing casting before and after drilling operations.

The performance of Cincinnati Bickford Super Service Radial Drills at Caterpillar Tractor Co. has been outstanding, steady and trouble free.

On this job, including drilling, tapping and reaming, 116 holes are produced, 14 are reamed within .0005″ tolerance. Caterpillar Tractor Co. also states Cincinnati Bickford Super Service Radial Drills have contributed to the advancement of their product.

Write for Catalog R-21-C.

BOOTH 901

80 YEARS OF SERVICE

CINCINNATI BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

THIS PLANT HAD THE RIGHT IDEA

but not the *Right machine*

The Right Machine can make a whale of a difference. Sometimes it's the difference between showing a profit or just getting by. Often (in a machine job shop) it's the difference between getting the order or losing it.

Remember, the true cost of a machine is entirely dependent upon its output. If you don't have the right machine on your job, it may pay you to see that your competition doesn't get one first.

CHANGING FROM 4-SPINDLE TO 6-SPINDLE OPERATION, THIS PLANT NOW SAVES PLENTY ON *BIG PARTS*

In a large screw machine products plant, the RIGHT machine for the job was a *six-spindle* bar automatic *large enough to handle up to 6" bars.* The 4-spindle machine they were using was large enough, but they needed the extra tooling capacity that 6-spindle operation could give them.

Could National Acme solve their problem? National Acme not only could—but did. Today this plant has an ACME-GRIDLEY "BIG 6-INCH SIX"—the largest six-spindle bar automatic ever installed in a screw machine products plant.

Today they enjoy all the production benefits on large parts that six-spindle tooling is giving them on smaller ones. The "BIG 6-INCH SIX" is breezing along day after day performing all operations simultaneously, with only the time required for the longest single cut controlling output. And it's doing it with just *one machine setup.*

We'll be glad to study your operation and give you our recommendation, with no obligation to you.

Remember: You can't do **TODAY'S** job – with **YESTERDAY'S** tools – and make a profit **TOMORROW**

ACME-GRIDLEY BAR and CHUCKING AUTOMATICS
1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Tapse Limit, Motor Starter and Control Station Switches • Solenoids • Contract Manufacturing.

The NATIONAL ACME COMPANY

171 EAST 131st STREET • CLEVELAND 8, OHIO.

NO down

Photos courtesy Century Machine Company, 4434 Marburg Avenue, Cincinnati 9, Ohio

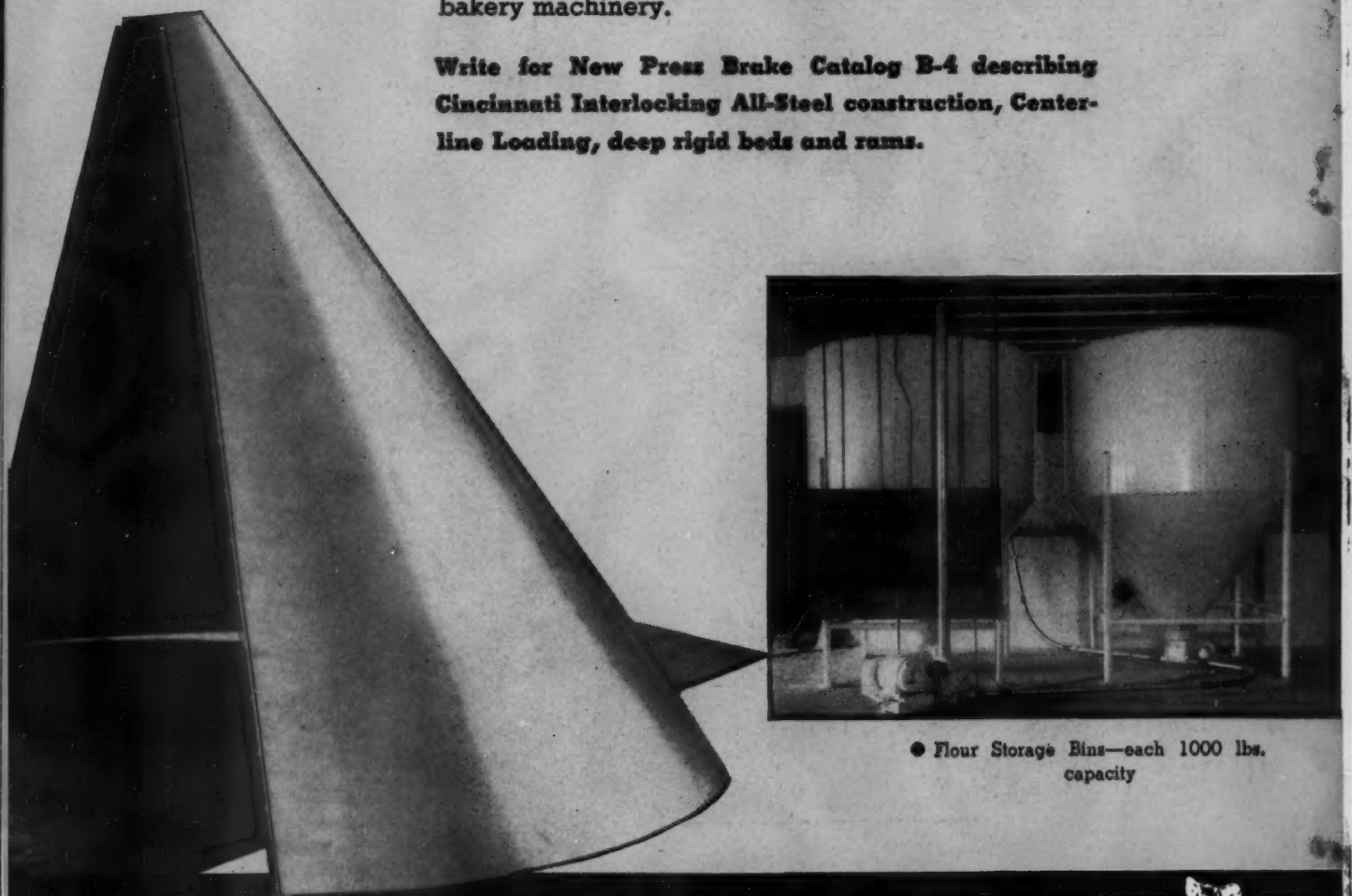
time in 16 years...

SEE
CINCINNATI
SHAPERS, SHEARS,
PRESS BRAKES
BOOTH 1105

The records of the Century Machine Company show "no down time in sixteen years use" on this Cincinnati Press Brake.

This machine, working a 9½ hour day, forms light gauge sheets in mild and stainless steel up to ¼" thickness. It is constantly producing accurate parts for easy assembly of Century's baking ovens and bakery machinery.

Write for New Press Brake Catalog B-4 describing Cincinnati Interlocking All-Steel construction, Center-line Loading, deep rigid beds and rams.



● Flour Storage Bins—each 1000 lbs. capacity

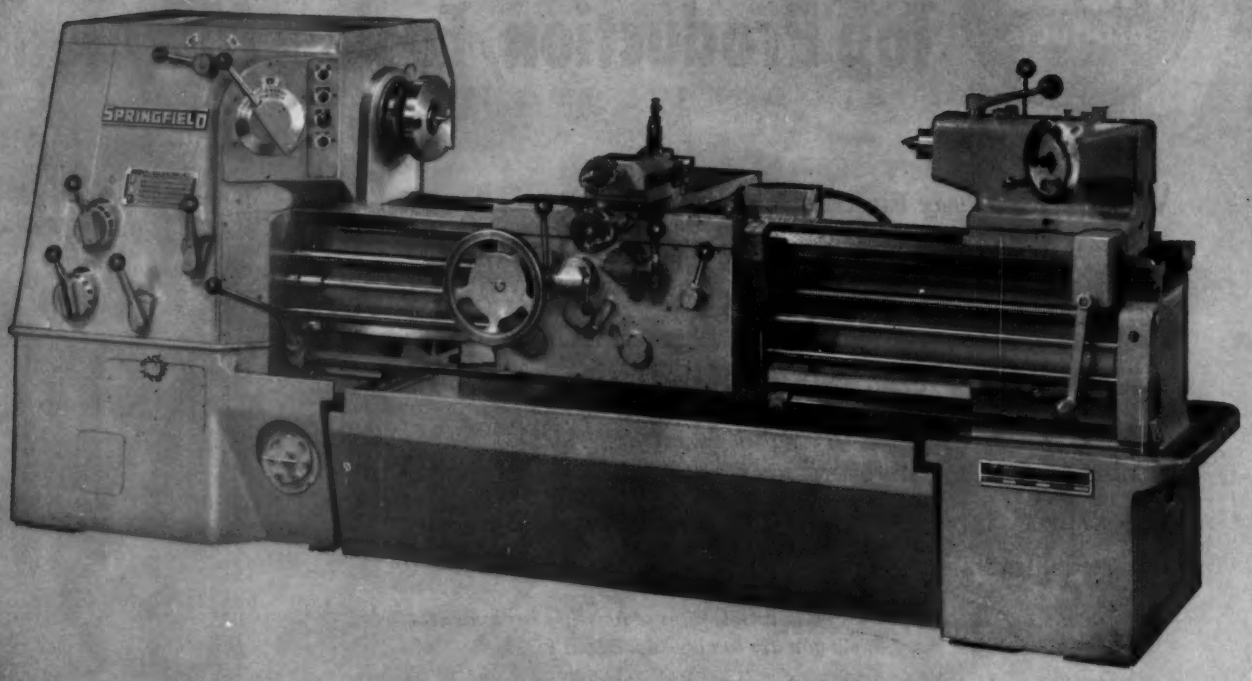
THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

SPRINGFIELD

See Springfield at Booth 612, Machine Tool Show, Chicago, Sept. 6-17.



more useful horsepower

All the horsepower in a Springfield Model "S" Lathe is productive.
A simple, straight-forward gear train, plus double-action lubrication, plus tight dynamic balance tolerances (.0005" displacement) eliminate friction and vibration, the twin horsepower thieves.
In the headstock, only the gears necessary to a given speed are engaged. Other gears run free with a stabilizing flywheel action, no drag on power.
A high pressure filtered oil mist keeps all gears and bearings drenched, and a cascade of oil lubricates the feed box.

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".
Vertical Universal Grinders: swings 18" to 42".

The Springfield Machine Tool Company
Springfield, Ohio
68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

Springfield

ACCO products

WRIGHT Electric Hoists for Top Production, Easiest Maintenance

WRIGHT *Speedway* Electric Hoists—Frame 1, Frame 2 and Frame 3—are ideal **HOISTS** for handling production materials where the load requirements **ARE** from ¼ ton to 10 ton capacity. Their design includes many advanced **SAFE** operating features. Sound choice of components provides them with **EFFICIENT** balance for smooth running. Parts are designed and built to give **RUGGED** performance with a minimum of care. Plant operating men find them **ADAPTABLE** to almost every type of shop work because of the wide range of speeds, lifts and mountings.

The more particular you are in your selection of hoisting equipment—the more likely you are to choose WRIGHT

Write our York, Pa., office for any or all of these fully informative bulletins—

Bulletin DH-133B on Frame 1 and 1½ WRIGHT Speedways
Catalog E-54A on Frame 2 and 3 WRIGHT Speedways
Bulletin DH-504 on WRIGHT Electric Roller Chain Hoist

ACCO

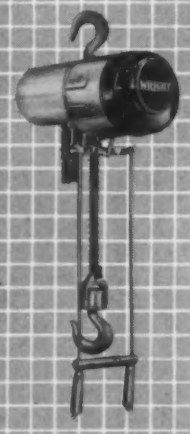
Wright Hoist Division
AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

for Better Value

SPEEDWAY HOIST FRAME 2 FRAME 3

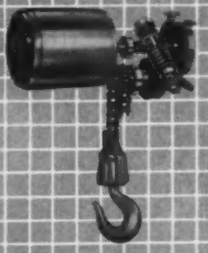
MOTOR BRAKE & SOLENOID FRAME 2 and FRAME 3 HOIST
"Nothing to adjust but the cam!"

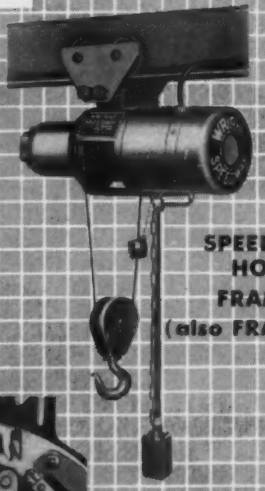


WRIGHT
Electric Roller Chain Hoist

- ¼, ½, 1 and 2-ton capacities
- Fewest number of wearing parts
- Self-locking, double-worm gear acts as own load brake
- Spring-set, shoe-type motor brake, clam shell type
- Oversize precision ball bearings
- Forged steel-alloy hook, swings and swivels

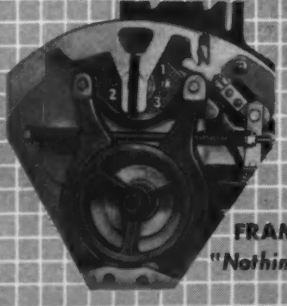
COMPETITIVELY PRICED





SPEEDWAY HOIST FRAME 1 (also FRAME 1½)

THIS DOUBLE-WORM GEAR ELIMINATES TROUBLESOME LOAD BRAKES



MOTOR BRAKE FRAME 1 and FRAME 1½
"Nothing to adjust but the cam!"

In Chicago...
you'll see for the first time

A NEW LINE OF GISHOLT MACHINES

identified by this medallion:

The new Gisholt MASTERLINE medallion identifies this new and improved series of machines—and re-emphasizes Gisholt achievements in building the master tools of industry since 1887.

Based upon nearly 70 years of specialized experience, the new Gisholt MASTERLINE machines are ready to give you production far in advance of their time.

Come in and inspect them at close range. Watch them operate. Learn what these new Gisholts can do to cut costs on your work.

Be sure to visit the Gisholt exhibit—Booth 1413, Exhibition Hall.

GISHOLT
MACHINE COMPANY

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

Whatever kind of gears you make...
Whatever way you make them

National Tool Co.

can supply the right type cutting tool
because we make *all* types

Gear Shaving Cutters

Hobs

National Tool Co., with 50 years experience in the manufacture of special cutting tools, makes *all* varieties of gear cutting tools for *all* types of spur, helical and worm gears—as well as for sprockets and splines. Whatever your gear requirements—large or small—National engineers can help you decide the most efficient method of producing them. Many gear manufacturers have found it profitable to look to National Tool Co. for all their gear cutting tool requirements.

Rack Type Gear Shaper Cutters

Gear Shaper Cutters

Involute Gear Cutters

Master Gears

Herringbone Gear Cutters

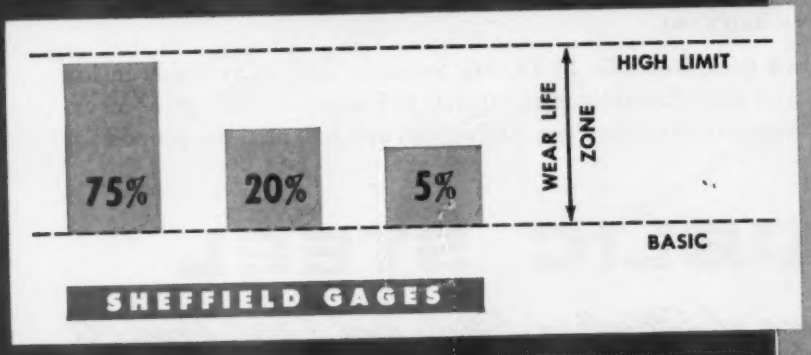
1905 • 1955
Our 50th Year

National
TOOL CO.
Cleveland 2, Ohio

Representatives in major industrial centers

WHY SHEFFIELD THREAD GAGES Wear Longer

Especial supersensitive production equipment controlled by high amplification instruments, plus Master Craftsmen make it practicable to hold the finished size of Sheffield thread gages unusually close to the gagemaker's high tolerance limit.



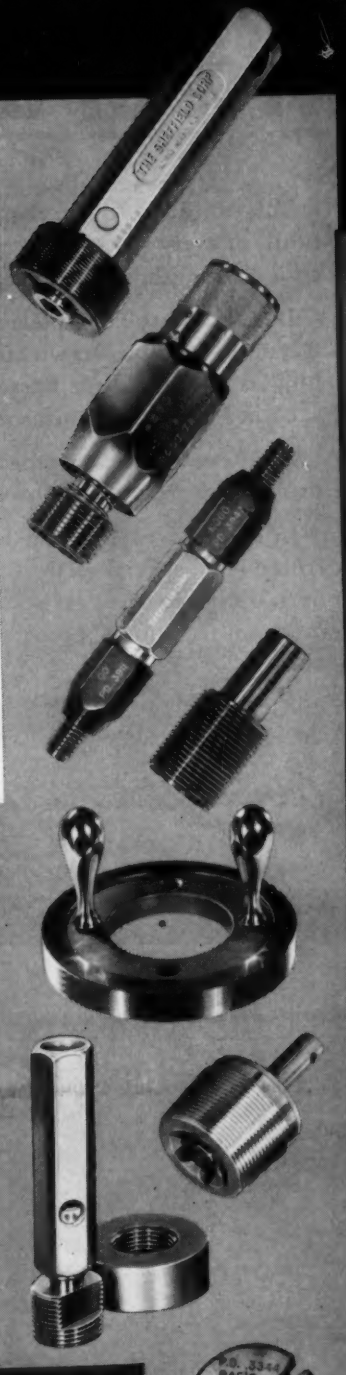
Purchasers of Sheffield thread gages can, on the average, expect to receive 75% of them within the upper third of the gagemaker's tolerance zone, 20% about half way and the rest between that point and basic.

SPECIFY SHEFFIELD and get more for your gage dollars.

SPECIFY "Reversible" Thread Plug Gages and save even more.

Gage Division, The Sheffield Corporation
Dayton 1, Ohio, U.S.A.

See us at the Machine Tool Show, Booth 1305



MASTER CRAFTSMAN SHEFFIELD HEADQUARTERS

SHEFFIELD

MANUFACTURE AND MEASUREMENT FOR MANKIND

You can machine Stainless Steel parts like these at rates up to 90% of Bessemer screw stock

You can do it with free-machining ENDURO Stainless Steel Bars. They'll machine beautifully at every station on your automatics. And you'll be giving your duplicate steel parts the added strength, appearance, and heat- and corrosion-resistant qualities of stainless steel.

Included in the complete range of stainless steel analyses supplied in cold finished form by Republic's Union Drawn Steel Division are two grades, A.I.S.I. 416 and 430-F, that are fully 90% as machinable as Bessemer screw stock. Add to this machinability the close tolerance, accuracy of section, uniform soundness and fine surface finish provided by cold drawing.

All these qualities combine to help you produce fine-quality stainless steel parts at highest production rates and at lowest unit costs.

In addition to cold finished bars, Republic ENDURO Stainless Steel is available in hot rolled bars, special sections and wire. Republic metallurgists and engineers will give you expert, obligation-free assistance on applications, processing and use. Just mail the coupon for more information.

REPUBLIC STEEL

World's Widest Range of Standard Steels and Steel Products

REPUBLIC STEEL CORPORATION
3102 East 45th Street
Cleveland 27, Ohio

Please send me more information on:

☐ Free-Machining ENDURO® ☐ Titanium

☐ ELECTRUNITE® Mechanical Tubing ☐ "Nylok" Nuts

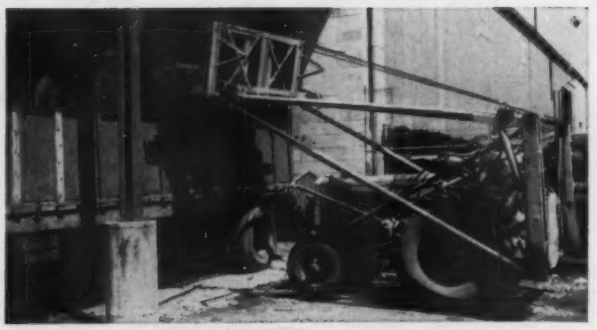
Name_____ Title_____

Company_____

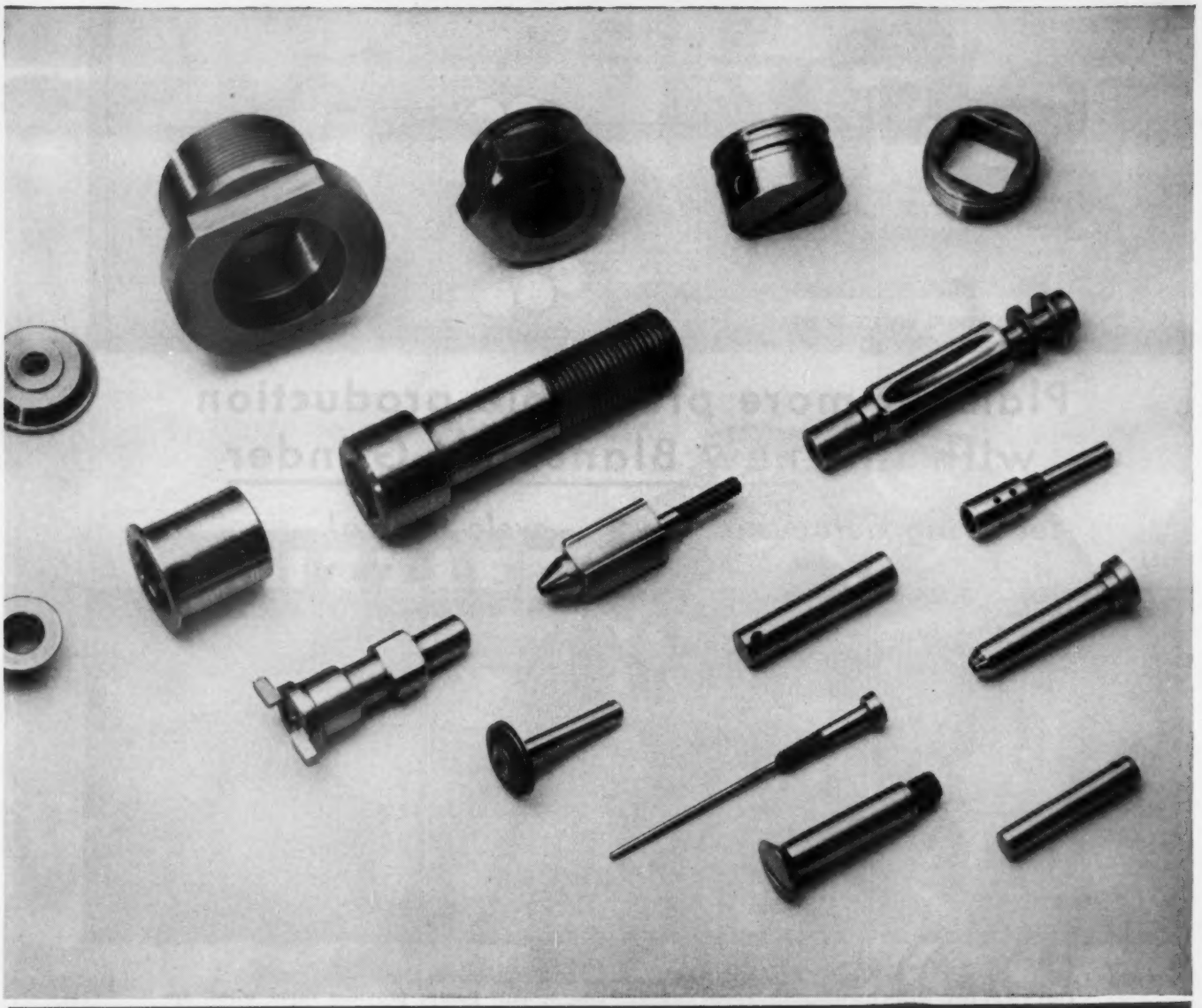
Address_____

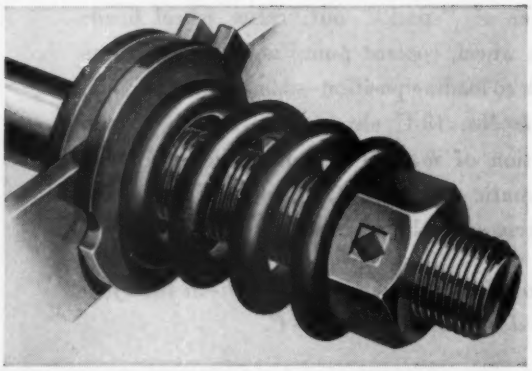
City_____ Zone____ State_____

K-6878



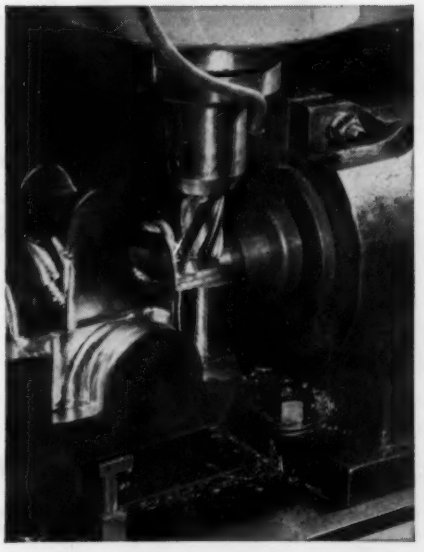
YOU CAN MASTER PROBLEMS LIKE THIS with ELECTRUNITE Mechanical Tubing. Interior scratches, not detected before assembly, wore out the hydraulic fluid seals in a hurry in the hydraulic cylinder of the Farmhand Hi-Lift Loader. Farmhand discussed the problem with Republic's Steel and Tubes Division. The solution—a switch to special smooth ELECTRUNITE Tubing. The result—lower production costs; fewer rejects; consistently uniform inside surface finish; longer life for the seal. ELECTRUNITE Mechanical Tubing is available in carbon and stainless analyses.

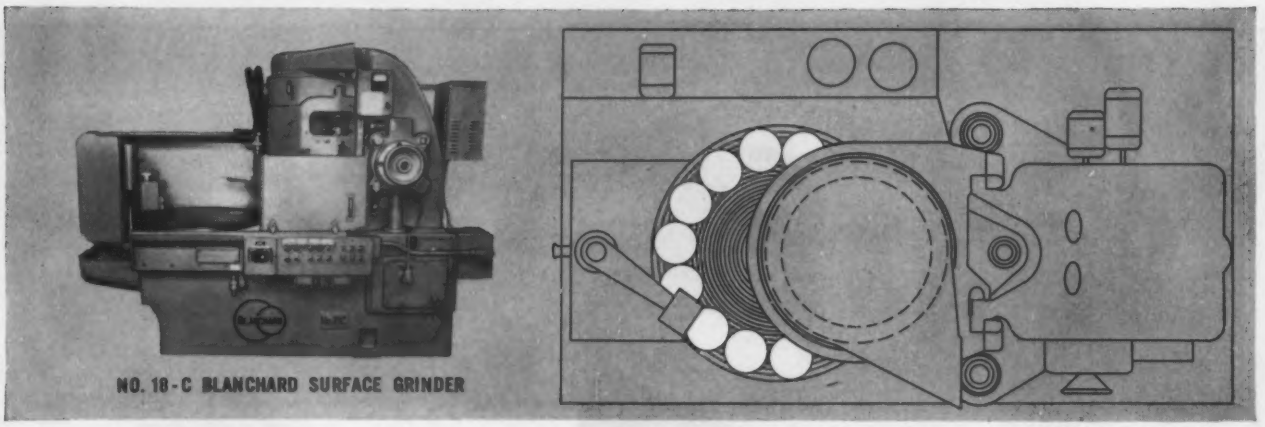




YOU CAN BE SURE THAT THIS NUT WILL STAY TIGHT wherever you stop wrenching. It's Republic's "Nylok" Nut. A nylon plug in the side forces the nut tight against the opposite threads as the nut is turned on. It can be assembled from either end, manually or mechanically fed. Can be locked in any position. Photo shows positive adjustment of spring compression.

YOU CAN MACHINE TITANIUM PARTS like parts made from many other metals. This part is being hogged out of a titanium forging. It will then be turned, drilled, reamed, ground, tapped and threaded. Republic metallurgists recommend metals without prejudice. They will tell you whether titanium can be adapted to your product—will help you use it to advantage. Republic produces titanium and titanium alloys in hot and cold rolled bars, sheets, plates and billets.

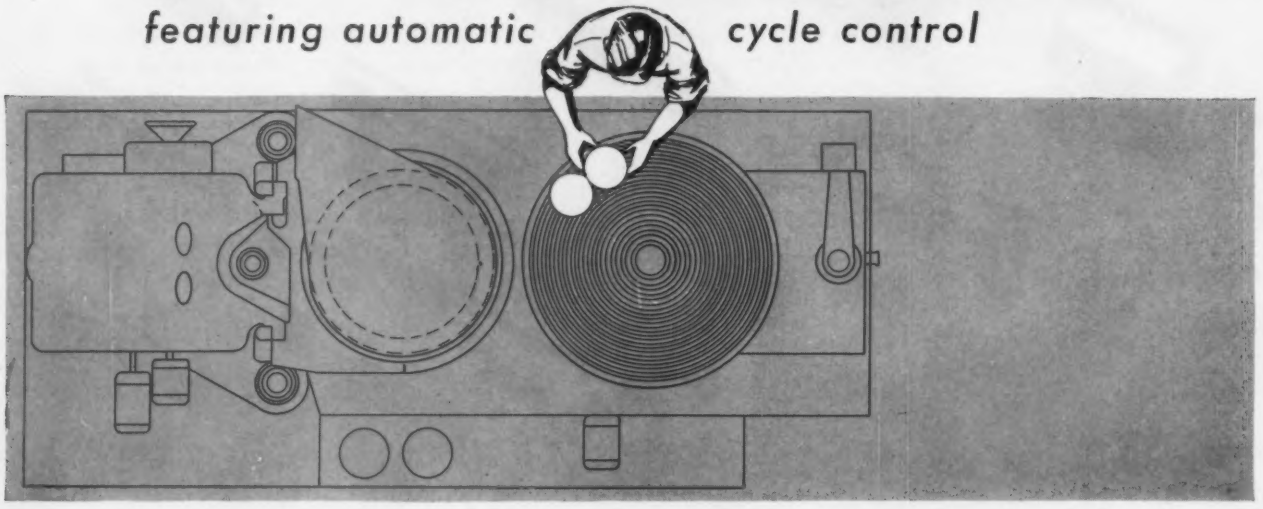




NO. 18-C BLANCHARD SURFACE GRINDER

Plan for more profitable production with this new Blanchard Grinder

featuring automatic cycle control



This great new Blanchard has the speed and simplicity which guarantee economical grinding on a wide variety of jobs.

One operator can easily operate two of these automatic cycling surface grinders. By using the automatic cycle, he can unload, clean and reload one grinder while the other grinds automatically.

The automatic cycle does everything else: moves chuck (30″ or 36″ dia.) to grinding position and starts it rotating; starts wheel rotation and coolant pump; provides rapid wheel approach to work; engages power down-feed at preset rate; changes to fine feed just before finished size is reached; stops feed when work is to size — "sparks" out; raises wheel head; stops wheel, coolant pump and chuck; moves chuck to loading position—demagnetizes chuck.

The No. 18-C also features: push button selection of manual or automatic operation; automatic size control; simple feed and head traverse controls; adjustable dwell timer.

This new Blanchard offers you many new production advantages. Look into them today — write for free catalog showing work done on the No. 18-C.

SEE THE 18-C AT
THE MACHINE TOOL SHOW
CHICAGO, ILL., BOOTH 406

PUT IT ON THE BLANCHARD

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

PUZZLED?

...about the problems of machine tool replacement?

IF SO...

GREATER SAVINGS

FINEST MACHINES

EASIEST PROCUREMENT

JONES & LAMSON offers you THIS COMBINATION

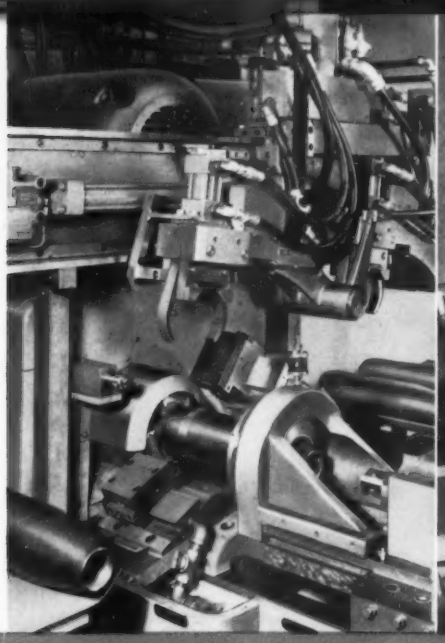
Modern machine tools that produce greater work accuracy at lower costs than ever before.

Scientific research in machining methods, metallurgy, tool geometry and inspection procedures.

Realistic Procurement — you have your choice of several sound financing methods, plus the advantages of new tax laws with more equitable write-offs.

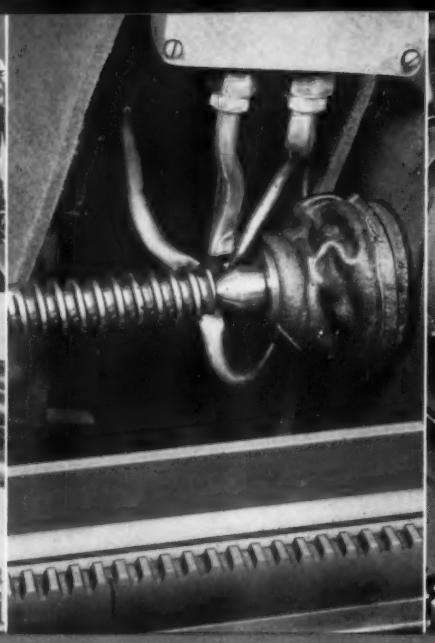
From initial survey of your production requirements right through to delivery and installation of new equipment, every phase of J&L's Replacement Program service is complete, competent and reliable.

The man who needs a machine tool . . . is already paying for it.



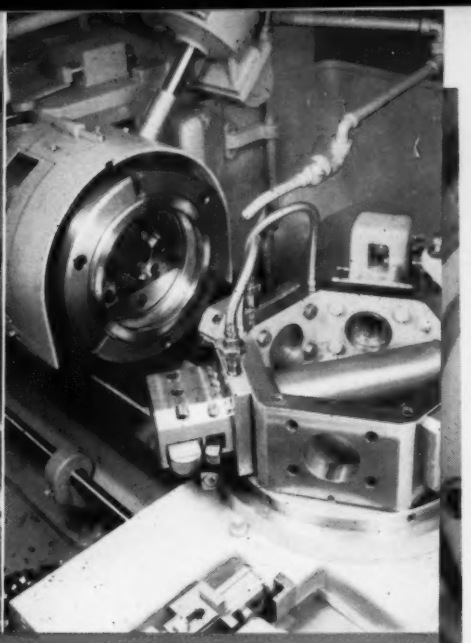
AUTOMATIC HANDLING

Completely automatic operation of this Fay Automatic lathe, including *loading*, *machining*, *chip and coolant disposal* and *unloading*, ups production to 180 pcs. per hour at 100% efficiency in the machining of these shells.



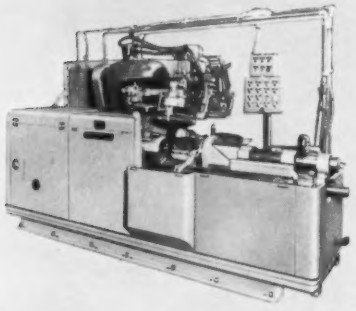
NEW METHODS

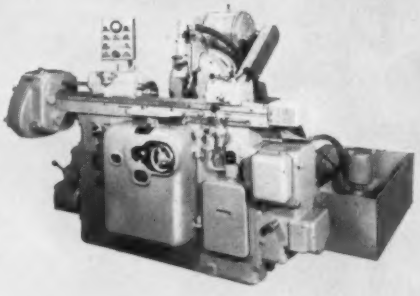
By grinding this worm (stock removal .1235″ — one pass) on a J&L 6 x 36″ Automatic Thread Grinder, production is increased 160% per machine over previous methods.

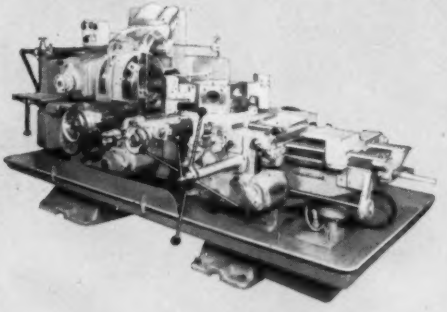


VERSATILE TOOLING

High production methods of tooling for automatic lathes were simplified and applied to three 7B J&L Universal Turret Lathes. Inner and outer Ball Bearing Races are produced on the same machines. Set up time from one lot to the next does not exceed fifteen to twenty minutes per machine.





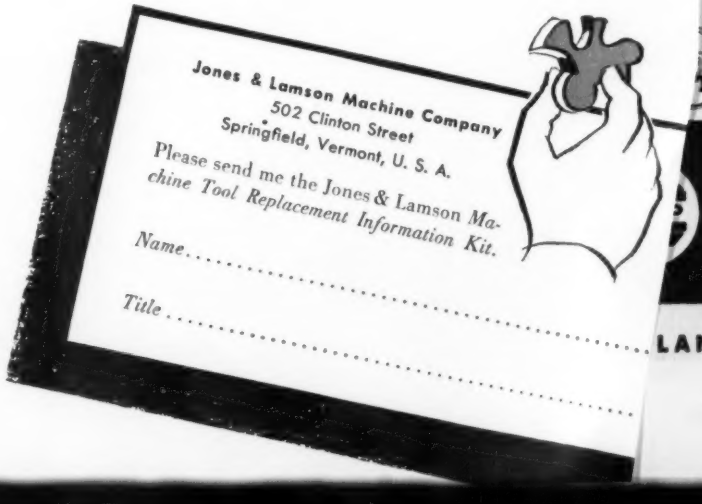


Jones & Lamson's unique Procurement Plan offers you a choice of methods for procuring new, high-efficiency equipment. You may buy outright; pay-from-productivity on a variety of bases, at interest rates of 3¼% and lower (add-on); or you may use any of several variations of a truly flexible lease plan.

JONES & LAMSON MACHINE CO.,
502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

Universal Turret Lathes • Fay Automatic Lathes • Automatic Thread & Form Grinders
Optical Comparators • Automatic Opening Threading Dies & Chasers
Automatic Double-End Milling & Centering Machines

Valuable information is yours for the asking. Simply fill in the coupon below, *clip it to your letterhead*, and mail.


Jones & Lamson Machine Company
502 Clinton Street
Springfield, Vermont, U. S. A.
Please send me the Jones & Lamson Machine Tool Replacement Information Kit.
Name.....
Title.....

LAND

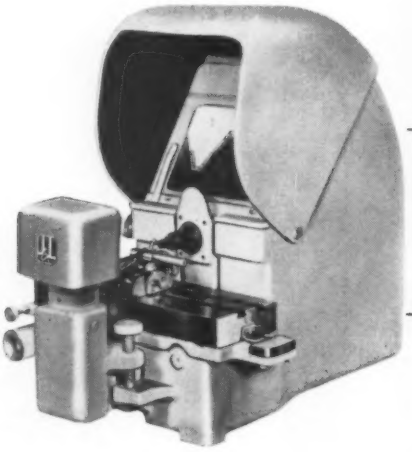
HOW TO "GUARANTEE A GUARANTEE"

Every set of Jones & Lamson Die Head chasers carries this full guarantee: *to produce Class III threads, or better, across the board.* To insure this guarantee, and to keep manufacturing costs down, J&L carries on successive interoperation inspections the positive way, with Jones & Lamson Optical Comparators.

(We practice what we preach)

Avoid costly work on scrap—
Prove machining results before subsequent operations

Controlled quality means lower costs. Use J&L Comparators on *your* production line . . . their versatility is unlimited.



Write Dept. 710 for information on Comparators and/or Jones & Lamson Thread Tool Products.

Dovetails of chasers are straddle milled. Tolerances checked on
The J&L OPTICAL COMPARATOR

Mill angle on front end of chaser. Length and angle checked on
The J&L OPTICAL COMPARATOR

Dovetail angle milled. Angle and centerline checked on
The J&L OPTICAL COMPARATOR

Ratchets for spacing are milled. Chaser length, ratchet form and spacing checked on
The J&L OPTICAL COMPARATOR

Back chamfer is milled. Angle and flat checked on
The J&L OPTICAL COMPARATOR

After heat treating, dovetail is ground. Angles, flats and depth inspected on
The J&L OPTICAL COMPARATOR

Grind thread form. Thread form, angles, root, crests, spacing, lead and helix checked on
The J&L OPTICAL COMPARATOR

Chamfer ground as specified. Angle and amount below root checked on
The J&L OPTICAL COMPARATOR

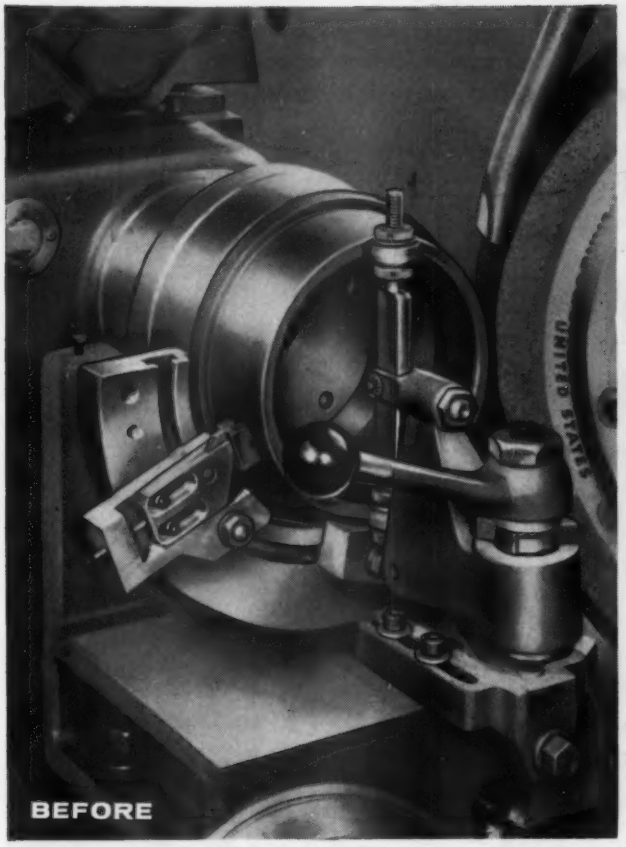
Top rake ground. End grind and point height checked on
The J&L OPTICAL COMPARATOR

JONES & LAMSON

World's largest manufacturer of Optical Comparators since 1919

JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.



New Taft-Peirce Magnetic Work Driver Cuts Shoe Type Centerless Grinding Costs

If you're considering or now doing shoe type centerless grinding, you should look into Taft-Peirce Magnetic Work Drivers. A variation of a rotary magnetic chuck, they hold work magnetically.

Simplifies setups. By eliminating complex tailstock arrangements.

Speeds production. Permits faster automatic or manual loading and unloading.

More versatile. Can be used for greater range of work sizes.

More dependable. There's little can go wrong with its simple, sturdy construction.

What's more, it costs substantially less than present complicated holding devices . . . requires little or no maintenance.

See them at the show — Booth 811

Furnished in either electromagnetic or permanent magnet models . . . designed to suit your requirements. Learn more about this time-and-money-saving work driver. Write today.

PERMANENT MAGNET CHUCKS | RECTANGULAR ELECTRO-MAGNETIC CHUCKS | ADJUSTABLE ELECTRO-MAGNETIC CHUCKS | ROTARY ELECTRO-MAGNETIC CHUCKS

T-P means Top Precision

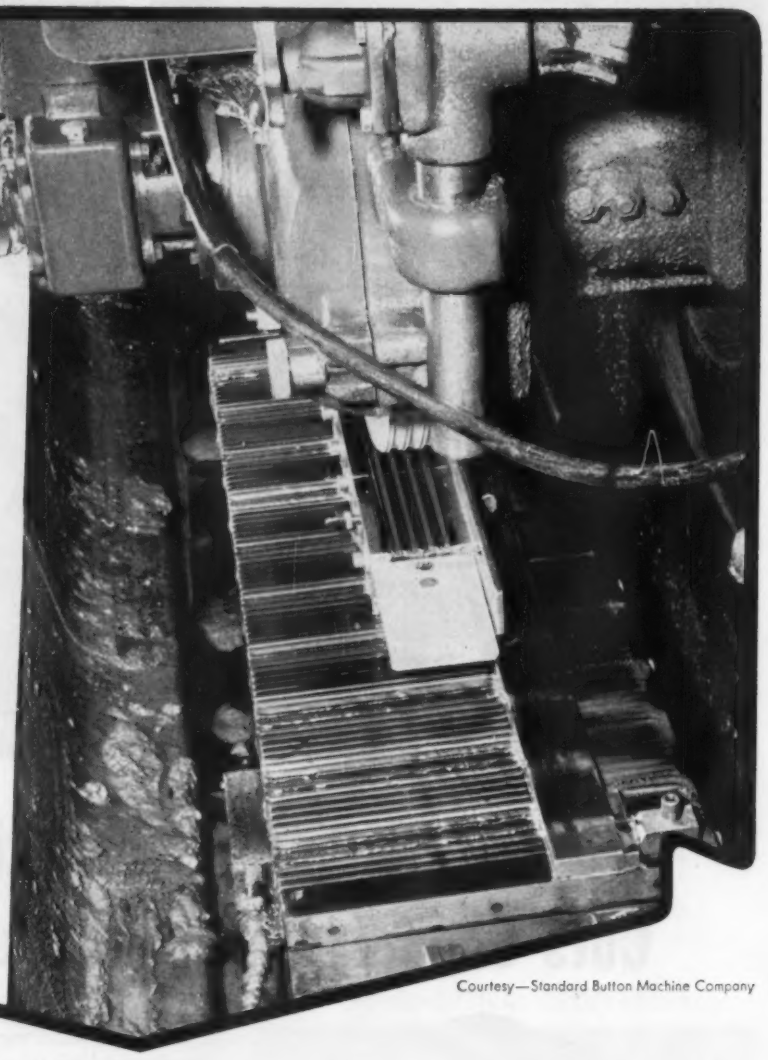
THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

CASE HISTORY NO. 3—HIGH-SPEED STEEL FACING TOOLS

MATTISON HIGH-POWER

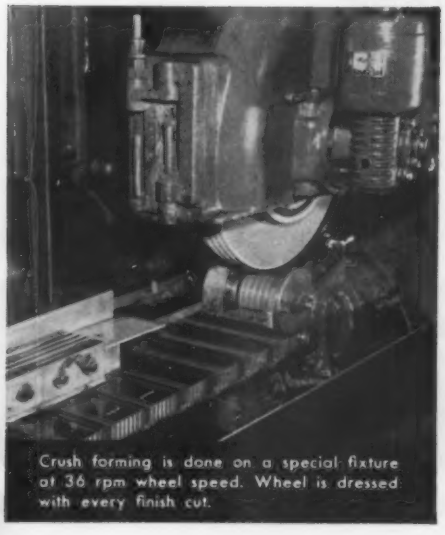
GRINDING METHODS

Tools are M2 High-Speed Steel, hardened to 63 Rockwell, "C." Fine micro finish results, using 220 grit wheel.



Courtesy—Standard Button Machine Company

Crush grinds 36 hardened h.-s. steel facing tools . . . holds .0005" form tolerance!

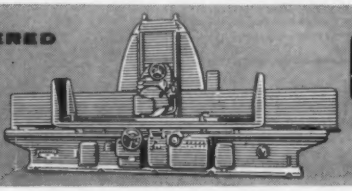


Crush forming is done on a special fixture at 36 rpm wheel speed. Wheel is dressed with every finish cut.

These hardened, high-speed steel facing tools are form ground with ease on the Mattison 12" x 16" x 36" High-Powered Precision Surface Grinder, and held to a machining tolerance of .0005". Jig holds 12 tools across and 3 end-to-end, or 36 per load. Finish, with 220 grit wheel, is between 15 and 20 R.M.S.

You can cut toolroom, maintenance, *and production* machining costs greatly with a standard Mattison Surface Grinder. Complex parts you may now be broaching, milling, or hand scraping can be shaped more accurately. Stock from rough castings can be removed at maximum speeds without cutter breakage. Tool sharpening and setup problems are eliminated, and you'll be surprised at the number of operations in your shop you can do better, *at lower cost*, on this high-powered, precision machine tool! 40 standard machines, table sizes from 12" x 36" to 36" x 192". Send for Bulletin "HP."

HIGH-POWERED SURFACE GRINDERS



MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.

Why Pipe Machinery Gages Can Never Be Cheap

The Finishing Room and Measuring Laboratory, the very heart of our gage plant, are both maintained at a constant standard 68 degree temperature.

Here, highly skilled, unhurried men and women, with a high average experience in this work, are the guardians of our quality. They work under ideal conditions and with the very latest of finishing and inspection equipment.

Shown on this page are some of the measuring and finishing instruments in constant use by these people.

Only because of this investment in experience and the very finest equipment can we assure you of the top accuracy that has made The Pipe Machinery Company a leader in the quality gage field.

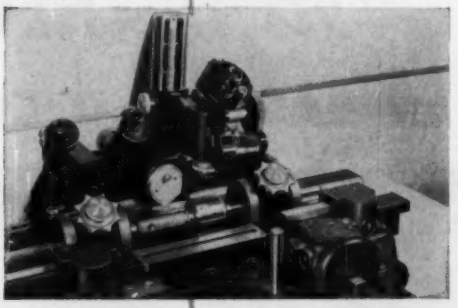
A REQUEST ON YOUR LETTERHEAD TODAY
WILL BRING YOU OUR CATALOG NO. 10

THE PIPE MACHINERY COMPANY

SINCE 1912

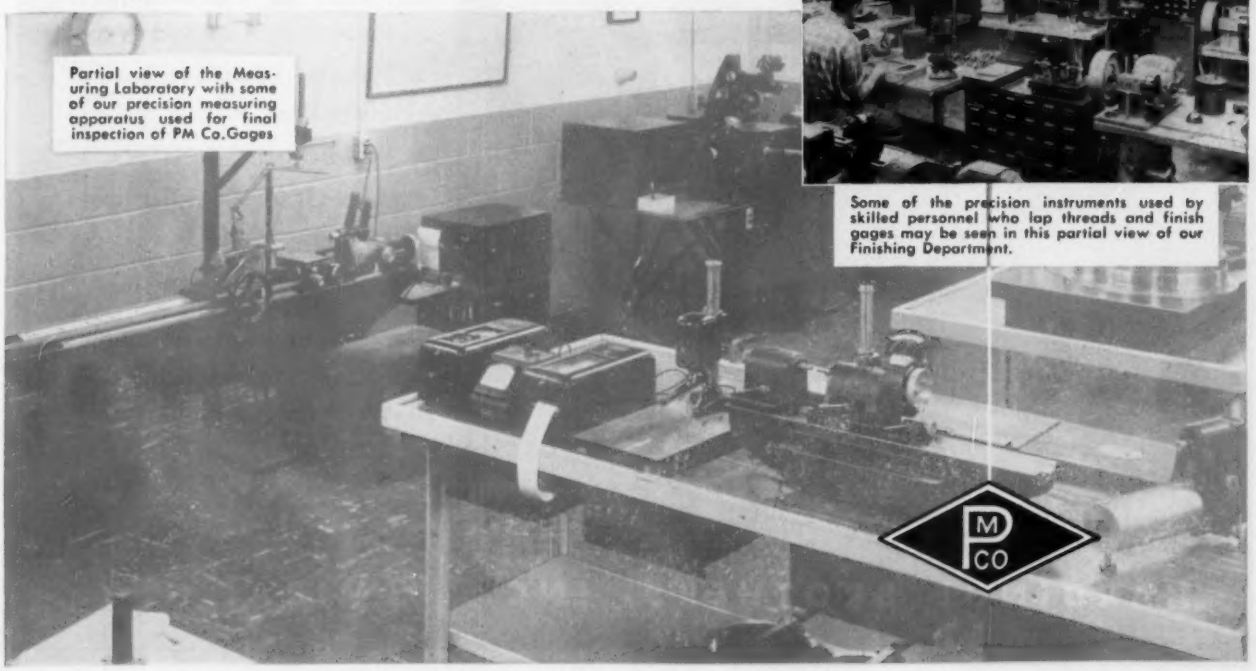
29100 LAKELAND BLVD. • WICKLIFFE, OHIO

Length Measuring Machine in our Measuring Laboratory used on lengths, diameters of thread gages, and for tapers for practical measurements to .00001"



This Universal Measuring Microscope magnifies 30 times and measures to half .0001"; permits easy estimation to .00001" on lead, angle, and thread depth.

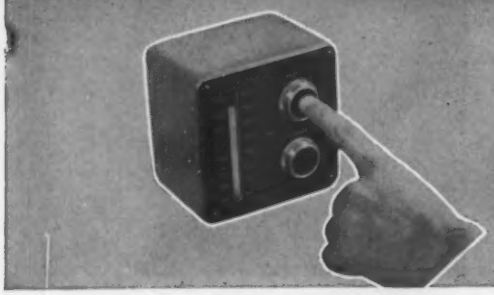
Some of the precision instruments used by skilled personnel who lap threads and finish gages may be seen in this partial view of our Finishing Department.



Partial view of the Measuring Laboratory with some of our precision measuring apparatus used for final inspection of PM Co. Gages

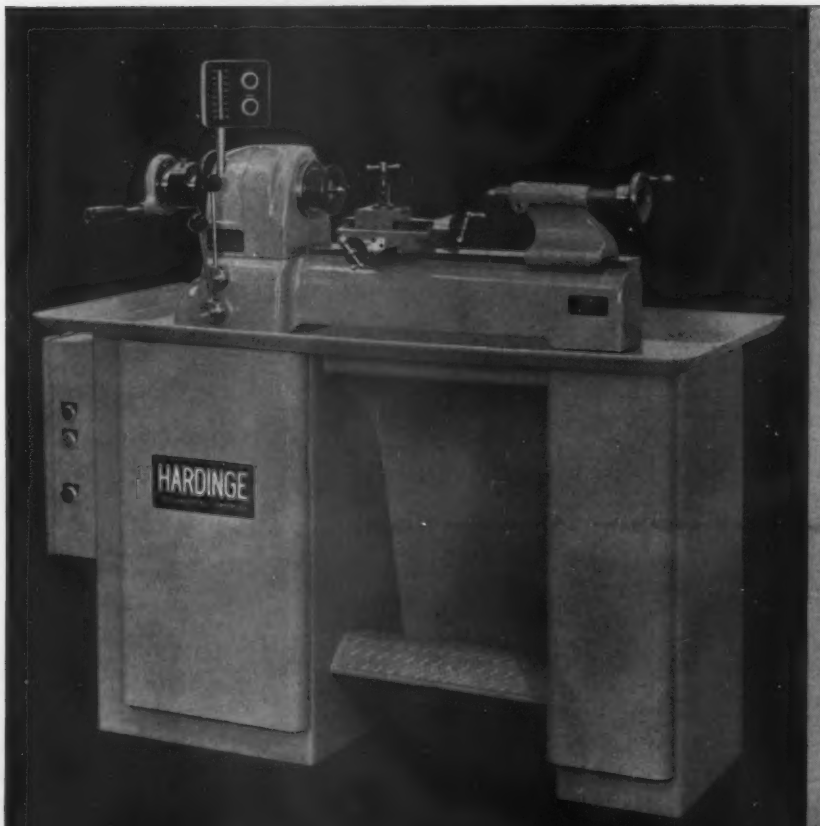
HARDINGE
ELMIRA, N.Y.

NEW Lathe with Variable Speed
for
Tool Room—Development—Production Work



Simply Push a Button for Exact Spindle Speeds

It's the NEW Simplified Design
EASY AND CONVENIENT TO OPERATE



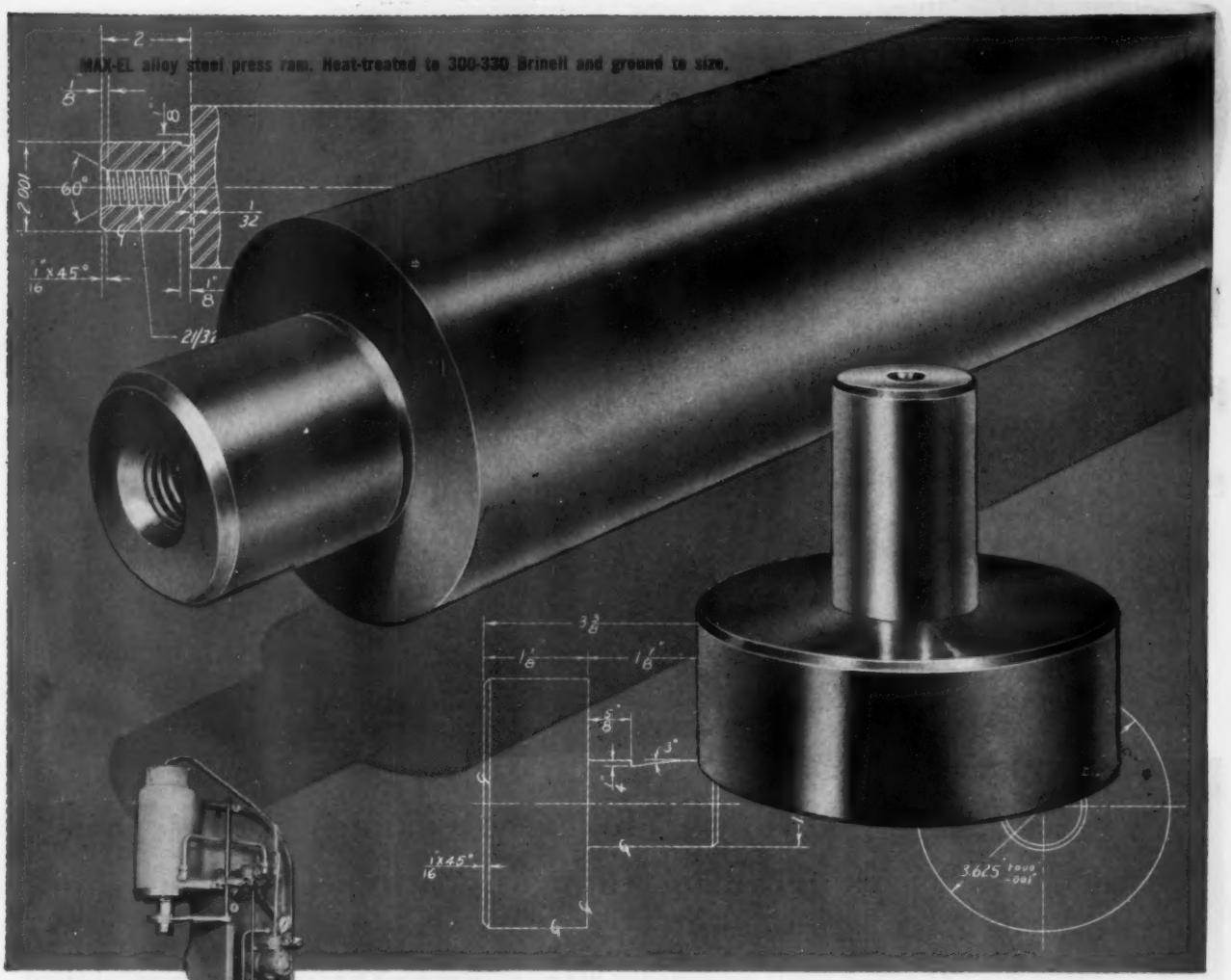
FEATURING:

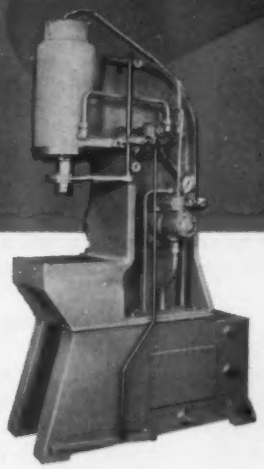
- Infinitely Variable Speeds 230 to 3500 r.p.m.
- Fast Lever Operated Collet with 1 1/16" Capacity
- Hardened and Ground Steel Dovetail Bed Ways
- Patented Positive Lock Slide Rest
- Full Bearing Tailstock
- And Other Cost Cutting Features

For Complete Information on this Precision Lathe Write for Bulletin DV59

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.





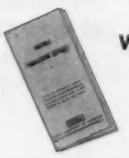
MAX-EL Alloy Steel means no distortion—longer wear in 15-ton hydraulic press ram

To keep this 15-ton press operating day after day for years of dependable service, takes *special* steels. For example, even after thousands of cycles of operation, the ram *must* remain accurately in line with the work table. *It demands a steel that will not distort, set or wear.*

That's why both the ram and ram-plug are made of Crucible MAX-EL alloy steel. In fact, the manufacturer, Greenerd Arbor Press Co., Nashua, N. H., has been a steady user of MAX-EL for many years.

Here's what they have to say—*"We have tried many grades of steel, but we find that MAX-EL 3½ heat-treated in the bar works out better for our application."*

And it probably will for yours, too. So when you have a job calling for a non-deforming alloy steel—one with excellent machinability, high-strength and wear-resistance—try Crucible MAX-EL. It's promptly available from your nearby Crucible warehouse, in the sizes and grades you need. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*



Write for your free copy of this *Crucible Publication Catalog* listing dozens of helpful booklets and data sheets.

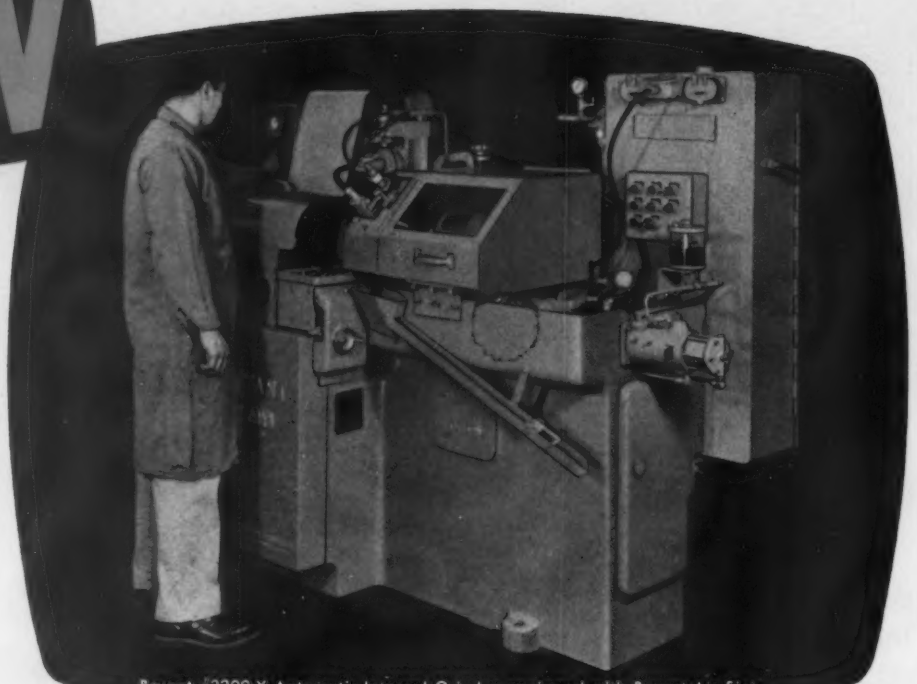
Visit us at Booths 830-832 Production Engineering Show, September 6-16, Navy Pier, Chicago.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

NEW

BRYANT air sizing . . .



Bryant #2209-Y Automatic Internal Grinder equipped with Bryant Air Sizing for automatic size control of bores

Be sure to see Bryant at the Machine Tool Show, *Booth 1015*

holds closer tolerances in internal grinding than any other sizing method!

This new method of sizing is designed especially for automatic production. It's extremely accurate, time-saving and economical—ideal for straight hole grinding when high-speed production, close tolerances and fine finishes are desired.

Bryant Air Sizing utilizes three principal operating components: Air Gage Panel, Bryant Impulse Timer and the Air Plug.

The Air Plug is mounted through the workhead and traverses continuously into the workpiece during the finish grinding cycle. Oscillation is timed and controlled from the wheelslide.

The Air Gage Panel measures the pressure peaks which occur at the air plug orifices each time the Air Plug enters the workpiece. These pressure peaks are multiplied to make gaging faster and more sensitive, and are then converted from pressure values into electrical impulses which operate the Bryant Impulse Timer.

The Timer continues the grinding cycle until the impulse signals stop, indicating that size has been reached. It then stops the grinding cycle and initiates the automatic loading cycle.

Bryant Air Sizing controls the size of workpieces *during the finish grinding cycle.* There is no contact between the gaging element and the workpiece. As a result, wear of the gaging element and possible scoring of the workpiece is eliminated.

Diamond sizing is used with Bryant Air Sizing to control size during the rough grind operation. *Write for descriptive literature.*

BRYANT

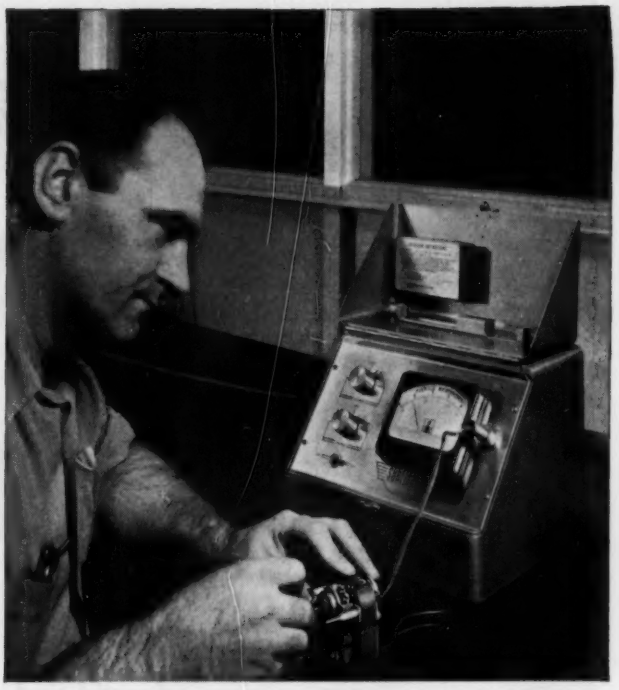
chucking grinder co.

10 CLINTON STREET, SPRINGFIELD, VERMONT

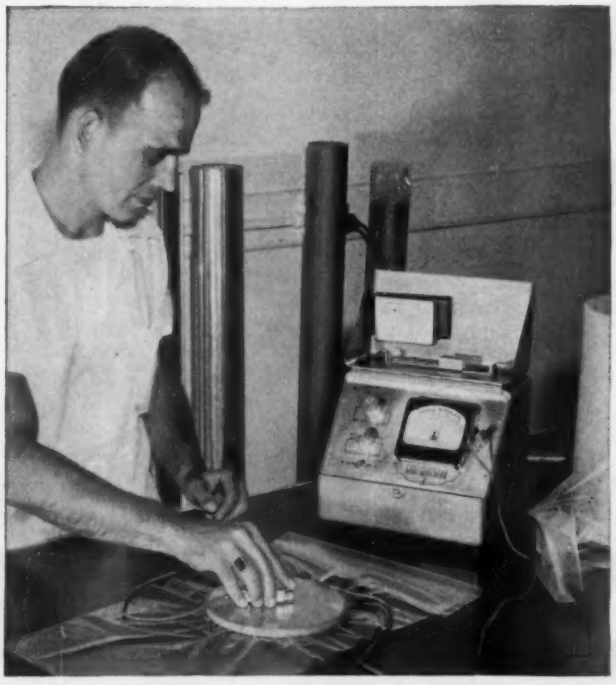
Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Boring Machines • Internal & External Thread Gages • Granite Surface Plates

"Saves inspection time" reports Rockford Acromatic Products Company. SURFINDICATOR is used to check finish of automotive, farm implement and appliance screw machine parts.



"Eliminates arbitrary decisions" reports Zenith Radio Corporation, producer of many ordnance parts with specified microfinish. Positive checks of surface finish cut production costs.



SURFINDICATOR is not restricted to metal surfaces. Here instrument is used by Celanese Corporation of America, 24 hours a day, in regular quality control checks of plastic film.

SURFINDICATOR*

This new inspection tool can save you time, cut your costs

Surface finish control is now a simple, on-the-job operation. With the Brush SURFINDICATOR, performance proved in hundreds of plants, you can quickly check surface roughness of any part. You can spot costly overfinishing, speed up inspection, eliminate finishing mistakes. Here is a precision instrument priced within the range of even the small volume shop . . . this instrument completely meets all the requirements of the new American Standard ASA B46.1, 1955 and the Military Standard MIL-Std.-10 for surface finish. For booklet or to request demonstration write Brush Electronics Company, Department U-8, 3405 Perkins Avenue, Cleveland 14, Ohio.

*Trade-Mark

BRUSH ELECTRONICS COMPANY

INDUSTRIAL AND RESEARCH INSTRUMENTS
PIEZOELECTRIC MATERIALS • ACOUSTIC DEVICES
MAGNETIC RECORDING EQUIPMENT AND COMPONENTS

BRUSH ELECTRONICS

Division of Clevite Corporation

Millions in Savings have made it

The Fastener

ASSEMBLY COSTS GO DOWN

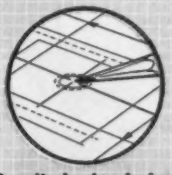
ASSEMBLY COSTS STAY DOWN

Save cost of tapping and tap equipment

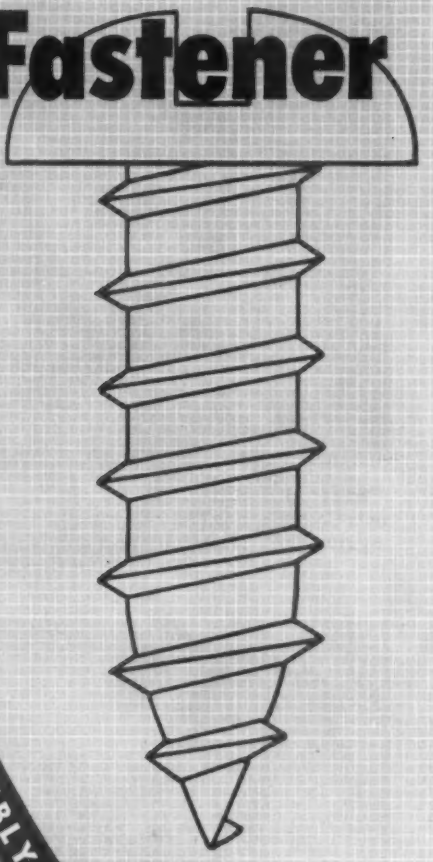
Save cost of "two-side" fastening — nut-running, riveting, etc.

Save cost of inserts for machine screws in plastics

Permit extra speed of power and automatic driving



Permit simpler design — fewer fastenings



PLAN FOR LOWER COST

from savings like these and from many more assembly advantages of Self-tapping Screws . . . then

PURCHASE TO *KEEP* COST DOWN

Insist on *P-K quality* to guard against screw failure and loss of most planned savings. Screw faults are hard to detect, but cost sheets and customer complaints soon show their effects — job slowdown, parts damage, high reclamation costs, loosening under vibration, hidden weakness.

P-K QUALITY STANDARDS PROTECT YOU

against "softies," and "cripples," — any defective screws. That's why *all* P-K Screws you get can be *Guaranteed First Quality.*

IN STOCK
See your P-K DISTRIBUTOR

PARKER-KALON®

Remember

. . . for screws that START RIGHT . .

IDEA of the CENTURY

In the past hundred years, the one revolutionary idea in threaded fasteners was pioneered by Parker-Kalon . . . hardened Self-tapping Screws.

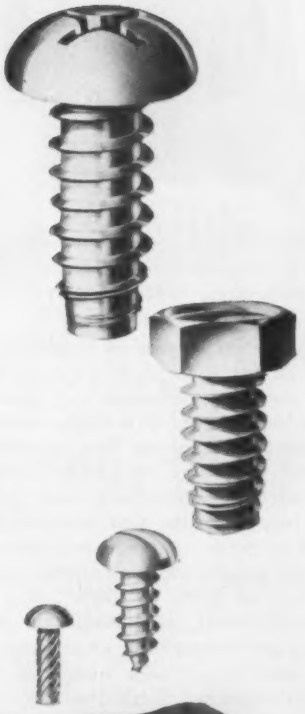
They offered simplicity, speed, and security for fastenings to metals, plastics, laminates, — savings impossible with conventional methods. They inspired the modern assembly techniques essential to mass production. Their contribution to cost reduction mounts by millions every year.

For almost any assembly, there's a big potential saving with Self-tapping Screws. But the promise can fade in production if screw failure snarls up the line. That's why quality standards for P-K Self-tapping Screws were set so high to begin with, and are still harder to match today.

Only Parker-Kalon can offer P-K quality, the indispensable extra, along with the proved advantages of Self-tapping Screws.

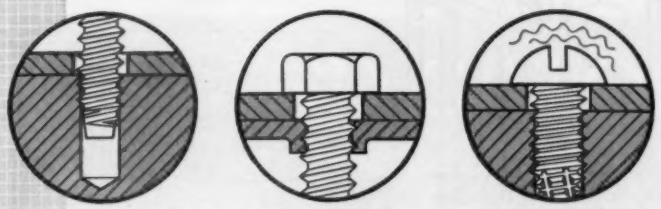
Only Parker-Kalon can offer P-K experience — covering many more years and millions more applications than any comparable record.

Plan your assemblies for lowest cost . . . a P-K Assembly Engineer will help you. Then make sure *planned* savings keep on *paying off* . . . when you purchase, order "P-K". Parker-Kalon Division, General American Transportation Corporation, 200 Varick St., New York 14.



The First originated by P-K . . . and *first* today . . . the leading choice for fastening economy

SELF-TAPPING SCREWS



. . DRIVE RIGHT . . . SEAT RIGHT . . . STAY TIGHT . . . **P-K** means **OK**

MAINTAIN the EFFICIENCY
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AUTOMATIC LATHES
and TURNING MACHINES
with the
OLIVER
20" TEMPLATE (controlled)
TOOL BIT GRINDER

The instant you equip your toolroom with an efficient Oliver, grinding time will be sharply reduced . . . production immediately expedited.

The Oliver method of single point tool sharpening utilizes a controlled and numbered template . . . grinds the complete tool in a single operation on one machine. The simple-to-operate 20" Template Tool Bit Grinding machine grinds single point tools in a fraction of the time required by other methods . . . reduces grinding time on tough tungsten-carbide work as much as 100% to 500% (using a notched wheel, with water on the wheel and through the wheel, makes this possible). Where quantities of precision-ground duplicates are required, the Oliver Way is the BEST!

Single point cutting tools machine ground on an OLIVER TOOL BIT GRINDER provide lasting accuracy *essential* to the efficient operation of automatic lathes and turning machines. Ground on an Oliver, single point tools have a fine finish . . . meet top standards without requiring the usual second operation of diamond-grinding. An OLIVER 20" TEMPLATE TOOL BIT GRINDER is a small investment for your toolroom that is sure to pay large dividends.

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Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Before and After

As in most matters, there are advantages and disadvantages in retaining that zero in front of the decimal place. I've weighed all the pros and cons I can think of. I incline to the belief that there are more and better reasons for retaining it, than otherwise.

Dispensing with the zero will save a small amount of space in a text. It may or may not save space in a tabulation. It will save some wear on the thin brass "0" matrices in the Mergenthalers. I can think of no other advantages; and these are insignificant.

I find nothing confusing in that single zero, which certainly is the case with a long string of zeros unbroken by commas. Retaining the zero is not time-costly; it takes the eye and mind no longer to see and remark "0.123" than it does ".123". If one is reading aloud something written "0.123", it is just as correct for him to say "point one two three" or "decimal one two three" or "one hundred twenty three thousandths" as it would be to say "zero decimal one two three". No one is going to requre him to *say* that zero in the figure being read; and he needn't do so unless emphasis or clarity in some particular instance suggests it.

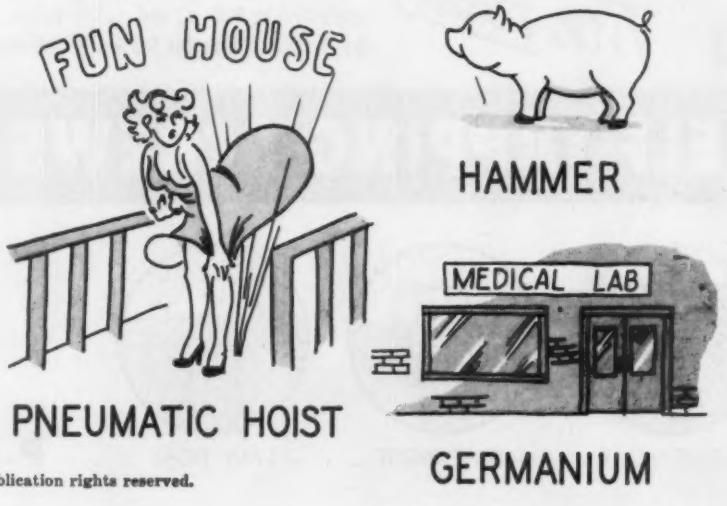
A purpose of all language is to transmit thoughts to others. Whatever may be permissible elsewhere, in technical language (spoken, written, and drawn) it is of prime importance to express thoughts simply, definitely, and clearly. The objective is to have as close to 100% of the thoughts land in the addressee's mind as possible, with a minimum of effort on the part of the addressee to translate what he hears or sees into language he understands. To that end, the speaker, writer, and printer should consider and choose the various tools of language—vocabulary, sentence structure, grammar, paragraphing, rhetoric, and punctuation.

Aligned with this is that comma which I suggested for figures like 0.000,6 for six ten-thousandths inch. The comma takes a little more space, adds a little wear on the comma matrix in the Merganthaler. But it's worth it. It reduces the effort required of the reader to capture as near as possible 100% of the writer's thoughts.

Similarly aligned with this is the Editor's suggestion that figures for hundred-thousandths from one to nine be written with the following zero, so they will be read as millionths from ten to ninety (thus, 0.000,010 to 0.000,090 instead of

GRINETICS

By D G SMITH



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for
W. H. NICHOLS Company

Precision holes ⊕ Mass produced by LELAND-GIFFORD DRILLING MACHINES

Producers of high speed, high precision metering and gerotor pumps . . . manufacturers of one of the most precise milling machines ever made — W. H. Nichols Company has a world-famous reputation for the quality of its work and the excellence of its production facilities.

For the many precisely located, exactly sized, and precision drilled holes involved in its operations, W. H. Nichols Company relies on the built-in accuracy of Leland-Gifford Multiple Spindle Drilling Machines. The flexibility of multiple spindles, the convenience of centralized controls, plus the Leland-Gifford indicating shift for instant, accurate speed changes . . . all contribute to fast, error-proof handling of precision work.

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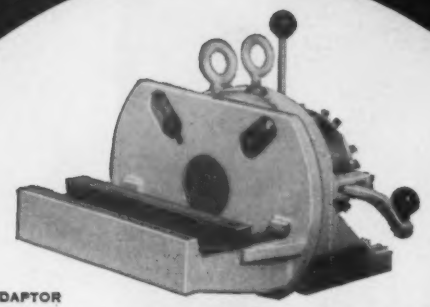
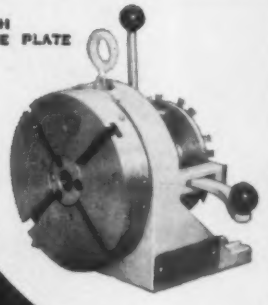
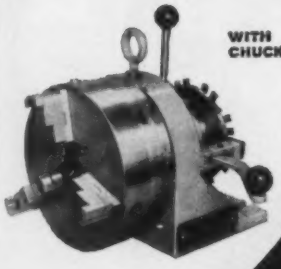
"...one of the most useful pieces of equipment in metal working plants throughout the country."



WITH RIGHT ANGLE ADAPTOR



WITH FACE PLATE



WITH CHUCK

3-WAY

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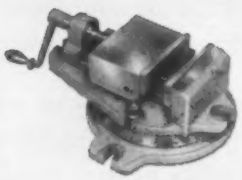
Gives new, *simple* mounting of work or jig plus rapid, controlled rotation to correct angular positions. Used on radial drills, boring mills, planers, milling machines, and sensitive drills.

This is a basic, versatile production unit which speeds up multiple same-piece operations on either long or short runs.

Request Bulletin J7 for complete details.



STURDY, ACCURATE machine vises, made with more than the usual care. Available with or without calibrated swivel base.

UNIQUE, SIMPLE work holder for indexing and positive clamping of difficult parts in milling or pantograph operations.

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WORCESTER, MASSACHUSETTS

0.000,09). The reasoning of his comment on my letter in Backlash is perfectly sound. And note, he is adding an "unnecessary" zero. (*AM*—May 23 '55, p94)

But to omit the zero before the decimal seems to me hardly aligned with this. Instead of suggesting by mere omission, that zero comes out flatly, definitely, and clearly with a figure that says that the amount is less than one. This is valuable in getting thoughts across clearly and quickly to people of all intelligence levels. But it does more than that. It serves as a signal to the Merganthaler operator and others concerned with getting correct figures in composition of text and tables. Witness; it is much easier to omit the decimal from ".123" than from "0.123". Moreover, that something had been omitted from "123" would

not be apparent although it is 1,000 times greater than the 0.123 intended. But that something is "wrong" would be obvious if a figure were written "0123".

And there is additional good typographical reason for retaining that zero. I shall point this out by an example. Consider this sentence:

> "Adding these amounts, 0.123, 0.456, and 0.789, to the previous total, 0.111, gives the same result, 0.999."

There's nothing hay-wire in that—apart from the addition.

But let's write it without the zeros:

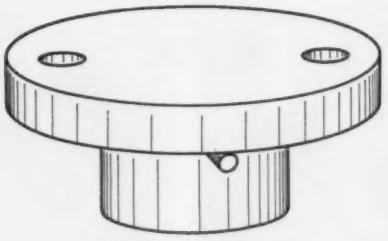
> "Adding these amounts, .123, .456, and .789, to the previous total, .111, gives the same result, .999."

When I declare that this *does* look a bit hay-wire, perhaps one may say that it comes from habit. I admit this; and if the habit is general, then it forms a reason in itself. But I also think it is a *good* habit. I mean to say, it is based on a solid foundation. I've consulted no Merganthaler operator, and I'm no psychologist who could predict people's confusions scientifically. I merely incline toward the suspicion that having the

decimal points directly follow commas will require more attention on the part of the operator, and therefore will lead to more mistakes in composition. Finally, I submit that that symmetrical gem in the last figure, ".999.", draws more attention to itself than warranted. Like a distracting detail in a picture, it mis-routes the mind of the person reading the sentence.

Perhaps you will tolerate those written "nothings" in the form of zeros if you look upon them as written symbols making for clarity, comparable with punctuation marks which, in reading, need not be (and usually aren't) expressed.

Lew Suverkrop
Bakersfield, Calif.



Hit and Run

After having read Mr H J Gerber's article (*AM*—Feb 28 '55, p132) and looked at the drawing, I just could not find out what he had gained with his design of a substitute for a drill jig. After he has punched the work, he is left with two center-punch marks and, as he says "a reasonable amount of care must be used in locating the drill." Anyone who has drilled holes from centerpunch marks knows how easily the drill "runs away" from the marks—usually because of poor drill grinding.

What is the reason for putting two centerpunches in the holes instead of using the drill through the holes to spot the location with two large holes of drill diameter. This will prevent the drill from "walking." You will pardon me if I baptise it a "hit and run" jig.

What is wrong with the good old design of a mark-up jig, as shown in the attached sketch? On cast-iron work, it is not even necessary to remove the jig when drilling the holes to depth. And a simple pin driven into the boss is just as effective, and much less expensive, than the full-length key shown in Mr. Gerber's drawing. The jig can be made of mild steel and cyanide hardened.

A Ruberg
Cape Town, S. Africa

THE *Complete Line*

GORHAM

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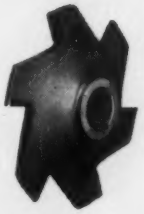

For profitable solutions to production milling problems, call on Gorham! Over thirty years' experience in creating fine cutting tools is your assurance of satisfaction.

An extensive line of *standard* end mills and milling cutters is stocked by Gorham distributors. When you need *special* tooling, a Gorham Field Engineer surveys your problem and makes design recommendations for a tool to be "tailor-made" for your application by skilled Gorham craftsmen.

Ask your distributor for Gorham "standards." For "specials," call in your nearby Gorham Field Engineer. They're both well qualified to help you . . . and backed by unmatched experience and facilities. For profitable solutions to milling problems, call on Gorham! There's no obligation.

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16″ and 18″ sizes . . . bench, floor and multi-spindle—power feed on larger sizes

Look at these handsome new drills and you'd guess they cost twice their modest price. Run them all day on production jobs and you'd say they're worth it. These are real machine tools, yet they're priced to a home workshop budget.

What does this mean to a machine shop, a maintenance shop or a school? It means that no job need go begging for modern equipment. No operator need sacrifice the safety and convenience of a full belt guard and built-in electrical controls. No production line need be slowed by old-fashioned drills. Not when clean, modern machine tools can be bought for prices like these.

New catalogs and specification sheets are ready on the 16″ Royals. Write for them and the name of your nearest Cincinnati dealer. Cincinnati Lathe and Tool Co., 3246 Disney, Cincinnati 9, Ohio.

18″ SINGLE-SPINDLE FLOOR MODEL WITH POWER FEED

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DRILLS FROM CINCINNATI

18" 3-SPINDLE
BENCH MODEL WITH
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16" SINGLE-SPINDLE
BENCH MODEL

Shop for a drill with all these built-in features supplied as standard equipment, then compare prices with the NEW ROYALS

1. Power feed at slight extra cost on 18" models.
2. Shipped complete with built-in electrical controls. Merely mount motor, connect leads and start drilling.
3. Direct-drive through simple V-belt transmits power to 6-splined spindle.
4. Easy speed change — raise guard, tilt motor, shift belt.
5. Full-floating spindle mounted in four precision, lifetime lubricated bearings.
6. Five spindle speeds on 16"; six on 18" drills.
7. Quick-set depth dial and positive stop.
8. Heavy column of ground tubular steel; castings of close-grained iron.
9. *Machined* working surfaces.
10. Built to definite standards of accuracy and tested before shipment.

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Are Built Extra-Rugged, Extra-Rigid, For

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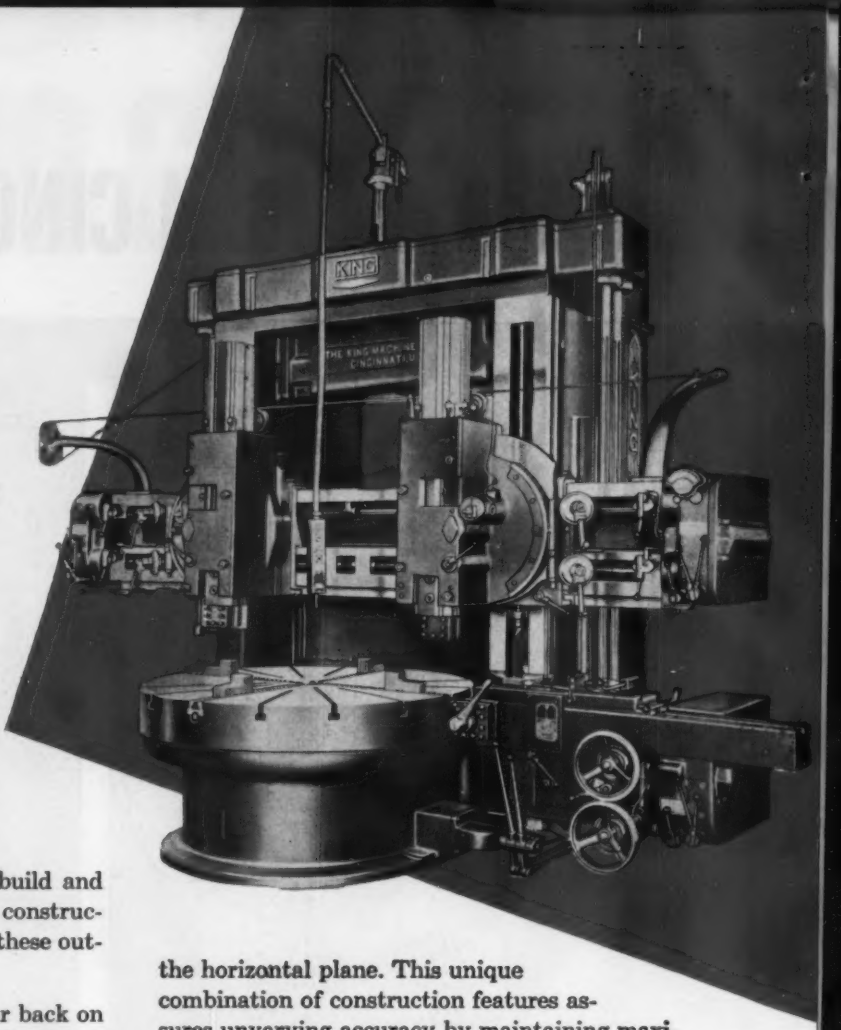
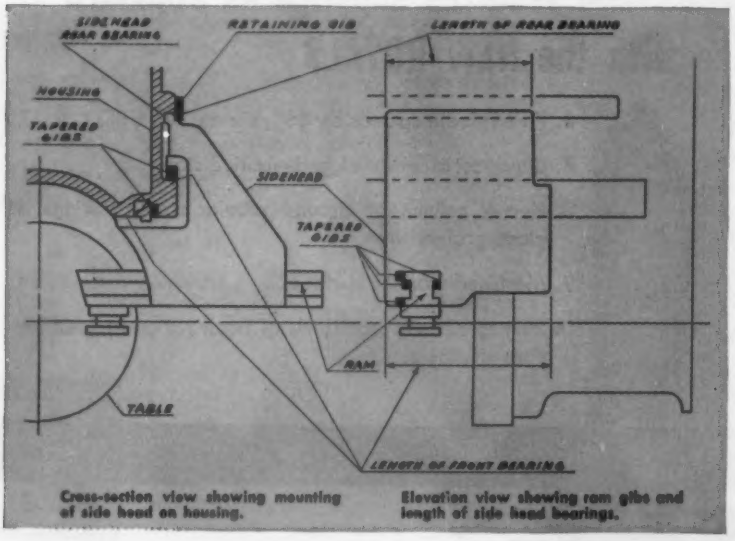


Typical of KING® superiority in rugged build and sturdily maintained rigidity is the side head construction illustrated and described here. Compare these outstanding construction details:

A full-length side head bearing is mounted far back on the side of the machine housing, extending back against the housing and held by a retaining gib. The other side head bearings are sturdily gibbed to the housing guides at all points of possible rotation, using adjustable tapered gibs. The accuracy of the ram within the side head is maintained by adjustable tapered gibs, two for adjustment in the vertical plane and two for adjustment in the horizontal plane. This unique combination of construction features assures unvarying accuracy by maintaining maximum ram and side head rigidity with resultant maximum resistance to deflection of the ram or rotation of the side head in any direction.

Extremely heavy cuts can be taken with the side head at feeds and speeds even beyond the capacity of the best modern cutting tools. Accuracy is maintained under the most severe conditions—such as work on pieces of small diameter in relation to table diameter, where the ram, extended inward, has considerable tendency to cause rotation of the side head.

This kind of *extra quality* construction *throughout* KING machines is your best guarantee of accurate, dependable performance. For full details see your King Distributor, or write us direct.



Cross-section view showing mounting of side head on housing.

Elevation view showing ram gibs and length of side head bearings.

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Spot News of Metalworking . . .

- **Solar energy to run automobiles?** It's possible, but not for quite a while. To prove that a car can be run on the sun's energy, GM will have a 15-in. model auto at its Powerama in Chicago in August. The model will have 12 selenium photoelectric cells that will convert solar light into current that runs an electric motor to propel the model auto.

- **Unique "share-the-skilled-labor" plan** is working out fine at Ryan Aeronautical Co, San Diego, where 15 jig and fixture builders and tool designers are on summer loan from Lockheed Aircraft's Marietta, Ga, plant to help meet peak tooling requirements. The men stay on Lockheed's payroll but Ryan reimburses Lockheed for their services.

- **British process measures metal coatings less than 0.020 in. thick,** the lower limit of coating thickness that can be measured ultrasonically. Process works on hard-to-measure magnetic materials, will be marketed commercially.

Buick's new automated pinion line at Flint, Mich (see p111) has been so successful that Buick is now automating two more such lines—for larger pinions. And GM's Detroit Transmission Division is installing one, too.

- **Italian firms will get loans up to $20 million for U S capital goods,** under terms of a recent agreement between the two governments. Fiat has already been granted a $6-million loan under the program.

- **IBM has come up with an electronic "brain bank"**—an integrated team of high-speed digital computers and data-processing equipment set up in New York to serve firms anywhere in the U S who require only part-time use of a computer. New data Transceiver permits subscriber companies to submit data from remote points via phone lines; get answer same day or sooner.

Cemented oxide-base cutting material will be demonstrated at the Machine Tool Show on high-speed machines by several builders. Still in the laboratory stage at GE Carboloy, the material has lasted 27 min in test machining of 1045 steel annealed to 170 brinell at 2000 fpm speed, 0.005-in. feed, and 0.100-in. cut depth. But Carboloy admits it's still tricky to handle—it's more brittle and susceptible to cracking than carbides.

- **Army Ordnance has an improved torsion testing machine,** designed by Pitman-Dunn Laboratories, that not only produces shear fractures, but allows accurate determination of energy and torque values, and indicates how the applied torques and specimen resistance fluctuate during testing.

- **Several huge machine tools have been in place for over a month** at the International Amphitheater, Chicago, site of the forthcoming Machine Tool Show. One—a 108-ton mechanical press—was up and ready for operation early in July.

- **Why the recent wave of mergers in Metalworking?** A private survey of 19 Michigan machinery manufacturers came up with this consensus: the little firm is caught in a squeeze between a growing market for his product and inability to get term loans to finance expansion. Only way out is to sell out to a bigger firm that can get the necessary credit. See p138.

Look for These Features in Drill Bushings

EX-CELL-O HAS THEM ALL

- **MATERIAL**—High chrome and carbon oil-hardening steel for maximum wear.
- **FINISH**—precision ground inside and out, and under the head for perfect bearing.
- **CONCENTRICITY**—assured by grinding on arbors after the holes are finished.
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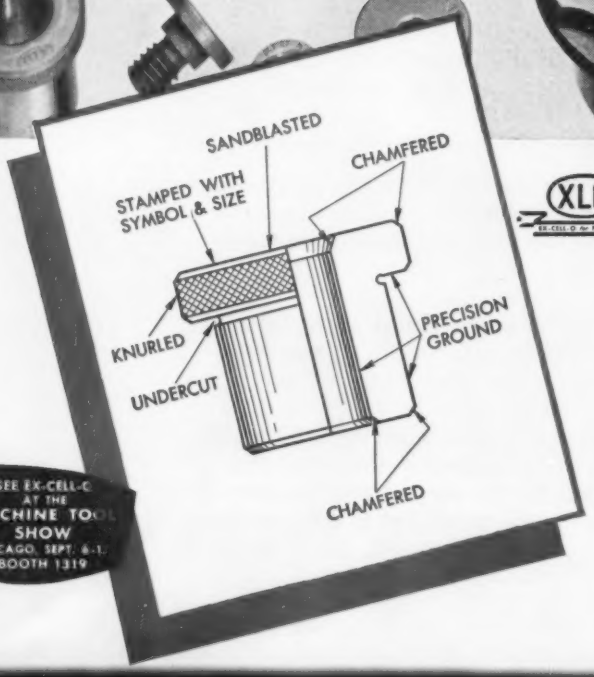
- **UNIFORMITY**—of material, dimensions, finish, and hardness assure accuracy, long life for both bushings and tools.
- **PROMPT DELIVERY**—from stocks of standard sizes in Detroit, New York, Los Angeles, and London, Canada.
- **PREFERRED**—largest bushing users in the country are Ex-Cell-O customers.



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AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

5-26

Washington . . .

New strategic thinking . . .

Air Force strategists are increasingly challenging our mobilization concepts. The issue may be brought to a head soon; it could involve a shift in Washington policy.

The challenge goes like this: because of the new nuclear capabilities of both the Russians and ourselves, the next war will likely be decided in a matter of 30 days or so. It would have to be fought with the forces in being at the time. There would be no opportunity to bring into play the broad mobilization base, which has been the key to US defense plans. Says General Twining, USAF Chief of Staff: "Industrial potential to be used after war begins has lost significance."

Of course, this thinking hasn't been bought outright by the National Security Council. But it could have an effect on future policy affecting defense production. The thesis makes obsolete many government mobilization programs: machine-tool stockpiling, mothballed plants, raw materials stockpiling, and broadening the production base—keeping the smaller, maybe less economic producers, in the business of making munitions.

Small business is on the warpath . . .

Congressmen are renewing complaints that too many military contracts are going to big business. They are putting pressure on Pentagon officials to split up the pie to more contractors, asserting that small business should not be solely dependent on subcontract work.

New target for attack is the new *Register of Planned Mobilization Producers.* Reducing the list from 40,000 to 30,000 knocks small businesses off the roster for contracts, say the Congressmen. Assistant Defense Secretary Pike says not: a producer who wants on can get on, and the new list is merely an updating. Of course, about 75% of contracts do go to big firms—which is the basic complaint.

Family fight over NLRB vacancy . . .

Conflict within the Eisenhower administration over labor policy has broken out again. Liberal and conservative factions—represented by Labor Secretary Mitchell and Commerce Secretary Weeks—are at odds over a candidate for the National Labor Relations Board.

NLRB Chairman Guy Farmer steps down next month with Mitchell backing his Labor Dept Solicitor Stuart Rothman for the vacancy. But opposition by Weeks and other conservatives appears to have blocked the move. In return, Mitchell is opposed to Michael Berstein, Senate Labor Committee aide to the Republicans, as too right-wing.

Also up for consideration is House Labor Committee Counsel Edward McCabe, who has no apparent enemies but isn't getting too much enthusiasm.

What may result is a dark-horse candidate; the same solution to the last Mitchell-Weeks dispute that brought "unknown" South Dakota judge Boyd Leedom to the NLRB.

The NLRB post is critical. With Farmer's leaving, there'll be two Democratic and two Republican members and these big issues still up in the air: whether an employer can require a strike vote among employees; whether employers and unions can agree to an illegal secondary boycott plan; what is disloyalty on the part of an employee and how should he be penalized.

Dispersal controversy . . .

Dispersal of military production is getting hot again, with manufacturers making no bones about opposing the Air Force "go inland" rules.

Northrop Aircraft is moving to El Paso with much of its operations to handle a guided missile contract.

Boeing Airplane is taking options on sites at Salt Lake and Denver to build the new Bomarc missile.

Marquardt Aircraft is having to look for an inland site for its Ramjet power plant.

Lockheed's Van Nuys, Calif, missile plant is on dead center.

The West Coast is protesting against the policy that new developments in the air and missile field will have to be done away from the coast as a defense against enemy attack. But the government holds to this view: we won't take away what coastal areas now have, but we will insist on new contracts going inland. Suppliers to aircraft and other affected industries will have to take note.

The peaceful atom . . .

Congress is going to vote money for a cargo-carrying atom powered merchant ship. It has turned down President Eisenhower's request for a "showboat". Instead, Democrats are pushing for a $30-million project.

Idea is to build a ship that will carry payloads. The problem of finding the kinds of metal and equipment to do an economical job is the big stumbling block. The legislation in Congress would direct the maritime to solve the problem, build an experimental model, with a specially built atom power plant.

Copper scarcity . . .

Copper supplies will be scarce for many months to come. Domestic strikes have reduced already small reserves to only a few days' reserve in many cases. ODM talks of drastic steps in the offing: possibly an emergency priority system for domestic copper supplies. Curtailment of copper scrap exports is probable.

The man who needs a new machine tool and doesn't buy it is paying for it anyway...

in hidden tooling costs

THE difference between your costs and your competitors' may be hidden behind the production line. It's the cost of maintaining your tooling.

There's time lost for tool sharpening! Extra floor space for extra machines in the tool room! Skilled tool dressers! Chuck alignment and maintenance! Production lost for wheel dressing!

One answer to hidden tooling costs is Microhoning

Instead of bits to be sharpened and wheels to be dressed Microhoning uses self-aligning, self-dressing tools. Throughout their life Microhone abrasives make clean, uniform cuts.

Look behind the production line and you'll find that your hidden tooling expense may total more than the cost of the latest type of Microhoning equipment, which would assure you of increased output, uniform quality, consistent accuracy of dimension and a functional surface finish. In short, you are paying right now for the new machine tools you don't have.

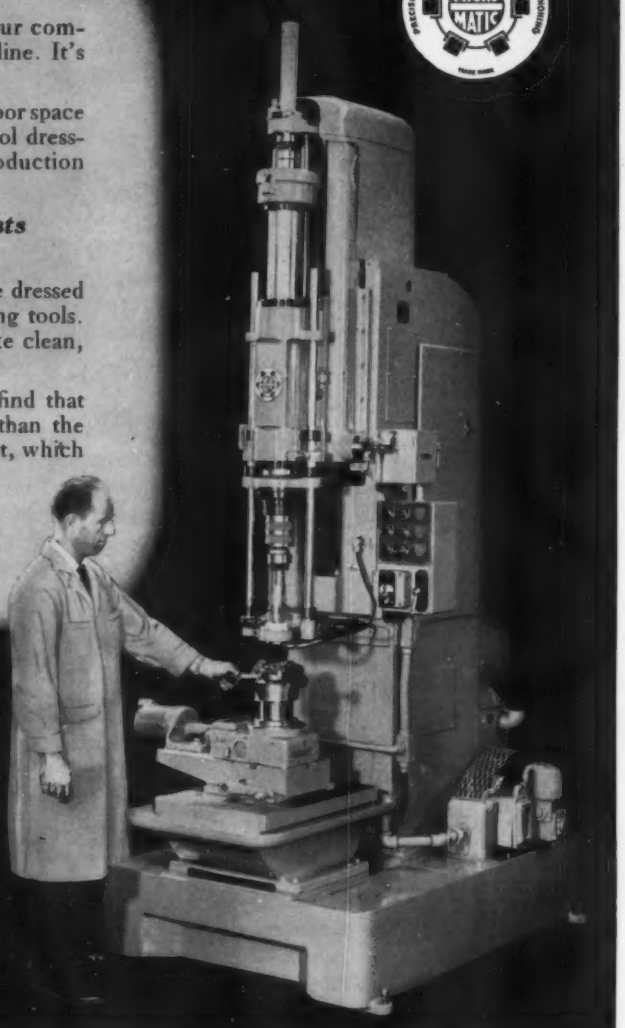
Surface: Spline in gear
Condition: Distorted by heat-treating

PROBLEM:

Excessive tooling cost—frequent changing and sharpening of tools—annealing of surface required—poor surface finish.

SOLUTION:

MICROHONING—Tool self sharpening—annealing not necessary—clean, consistent surface finish generated.



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MICRO-PRECISION DIVISION • 2205 Lee Street, Evanston, Illinois
Hydraulic controls • Diesel fuel injection equipment

Detroit . . .

Childish and churlish . . .

. . . is pretty much the attitude of many otherwise mature auto men when safety devices for cars come up in conversation. If one engineer suggests use of a device that might save a life here and there, another engineer is sure to snort derisively: "Lap straps? Just something to keep part of you in place while the rest of you rams the windshield!" Or: "Padded panels? Won't do a thing, except maybe save your kid's teeth in a sudden stop."

Auto safety . . .

. . . is discussed frequently in the industry, usually emotionally, and very often with one eye cocked on the customer's dollar. It's a subject that's going to be discussed, advertised, promoted and ballyhooed even more thoroughly when some 1956 cars go on the market. The kick-off was Chrysler's announcement that it would put seat belts on sale. Ford followed with a similar revelation, then added that it would sponsor a safety forum in September. There'll be much more to come.

Interesting merchandising problems . . .

. . . will arise, say some sales people, because some car makers will be trying to sell a negative idea: admitting publicly that people can be killed or injured in autos. Any company which jumps off with an all-out safety promotion is tacitly confessing that its product, and those of other manufacturers, are not the safest things in the world, that autos can be lethal when in incompetent or irresponsible hands. Maybe, say sales people, that admission will send customers to another auto maker who had admitted nothing—least of all that people can be killed by cars. Auto makers are aware that the public knows upward of 40,000 people are killed annually in auto accidents. The industry just never has figured it's a good idea to use advertising dollars to call attention to the fact.

Up to now, accident prevention . . .

. . . has been the only safety sales argument actively pursued by the industry. Better brakes, headlamps, bodies, tires, etc, are items that help to prevent accidents. But this fall, the advertising and promotional activities of some car makers will say, in essence: "So OK, anything as big and fast as a car is capable of hurting or killing people. We're making the product as safe as we can, but some of you will still crash. So we're adding some devices that may save you if you should pile up."

An altruistic concern for the motorists' safety is not the only force pushing such programs. Said an engineer, mentioning the plans of another company: "I didn't notice their engineering department making noise about safety until the sales department said it needed something more to sell."

The profit motive, of course, already is apparent in the seat belt price announcements. Other safety devices due for fall introduction will be available only at extra cost, too.

Some courage may be required of a company planning to push safety. There's still no proof that a demand for safety exists. If a company dumps several million dollars into a program to find out if safety is saleable, and safety devices are roundly rejected, auto makers may be justified in saying: "OK, forget about energy-absorbing steering wheels, pop-out windshields, padded dashboards. Give 'em more chrome, more horsepower, more gloss."

Don't look for any startling safety innovations in the '56 models. There'll be a number of devices available from factories and dealers that have not been merchandised extensively before, but they're all items that race car drivers, independent crash research agencies and others have been recommending for years.

The GAW squabble goes on . . .

. . . and on around Detroit, mostly without purpose. Most recently, the conversation piece was a booklet published by Ford, defining its supplemental jobless pay scheme. In an introductory passage, John Bugas, Ford industrial relations chief, said Ford in its settlement succeeded in avoiding the "dangerous principles of the UAW's 'guaranteed annual wage'," added that Ford was worried that UAW might be able to force a settlement elsewhere in industry, and on UAW's own terms. ". . . a break-through could have happened in the automotive industry later this summer," Bugas wrote, in an obvious reference to Chrysler.

To which charge a Chrysler executive replied: "Why do they (Ford) keep explaining—or apologizing for —what they did? Why?"

Solar energy for vehicles . . .

. . . cannot be practically applied now, says GM, but a look at the possibilities will be provided visitors to GM's Powerama to be held late in August in Chicago. A 15-inch model car equipped with 12 photoelectric cells made of selenium, an element which can convert light into electric power, will be demonstrated. The car is propelled by an electric motor powered by the current provided by light.

Michigan's Metalworking mergers . . .

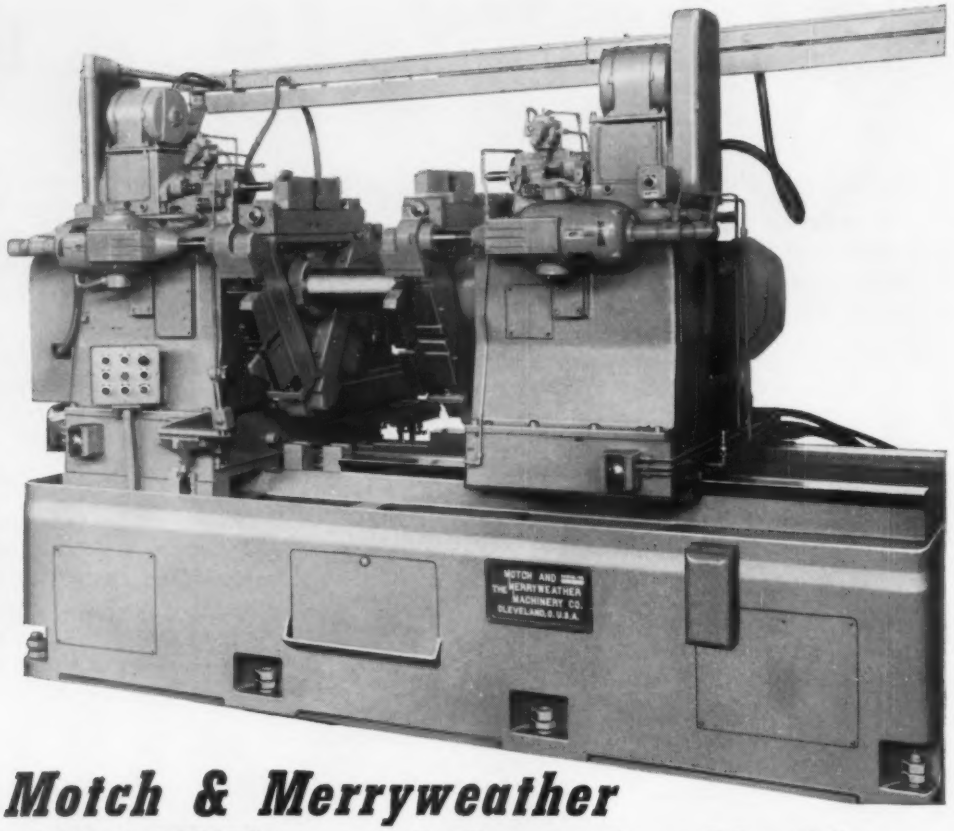
. . . are the result of a squeeze play on the small manufacturer, who could and would expand but can't get enough bank credit. So he sells out to a bigger firm that can get needed credit. See p138.

Heavy Duty

Rigid

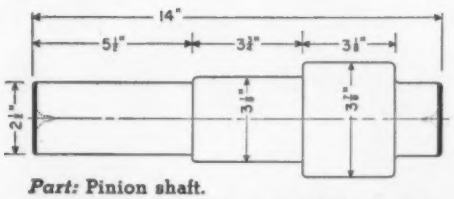
Accurate

Productive



The Motch & Merryweather
No. 3-MCT Milling and Centering Machine
FOR UNIVERSAL PRODUCTION

Adopt this Active Asset to Automation



Part: Pinion shaft.
Operation: Mill and center drill both ends.
Production: 220 pieces per hour.

Mass production, yet with extreme accuracy, — that is the central requirement for preparing parts which go to your automatic equipment. Begin automation *right* by preparing your parts *right* on the Motch & Merryweather 3-MCT Milling and Centering Machine. This universal heavy duty unit excels for high single-purpose production, while quick set-up makes short runs profitable. Automatic loading and unloading may be incorporated to handle extremely high production. The 3-MCT performs with a dispatch and precision hitherto unknown.

THE MOTCH & MERRYWEATHER MACHINERY CO.

MACHINERY MANUFACTURING DIVISION
CLEVELAND 13, OHIO

Builders also of Production Milling, Vertical Turning, Automatic and Special Machines

Machine Tools . . .

Buyers placing big orders . . .

Machine tool orders went up again in June, after a spectacular rise in May. Preliminary estimates show that they were around $80 million, or some $8 million more than in the previous month.

July is proving to be a good month, too, for new business. Substantial orders continue to come out of Detroit. All the Big Three—General Motors, Ford and Chrysler—have made sizable purchases of machine tools the past few weeks.

Some machine tool builders report that bookings are spread over a wider range of customers than at any time in many years.

Pentagon to have replacement formula . . .

Department of Defense is working on a machine tool replacement formula that it hopes will be good enough to be used by all branches of the armed services in measuring replacement needs.

The formula, it is reported, will not be applied on the basis of mobilization requirements of two and one-half shifts, as proposed in the formula developed by the Bureau of Ships of the Navy.

Navy surveying aircraft factories . . .

The Navy is in the midst of making a survey, with as little fuss as possible, of the plane and plane engine facilities of some 50-odd manufacturers from coast to coast.

Purpose is to relate present capacity to M-Day needs and fill in any glaring deficiencies.

About a dozen of the companies have been covered thus far. Completion of the project is reported to be some time off.

Field work is being done under direction of a well known former automotive production expert whose personal standing commands respect.

Navy, whose Bureau of Air has a big stake in aviation production, would like to have full support of the Air Force in this project. It is understood to have made overtures in that direction.

US builders to produce in England . . .

England is a focal point of interest for a number of American machine tool builders just now.

One large US builder has recently begun manufacture of at least one line of his tools in England.

Another company, through its subsidiary British company financed from here, is to start soon to make its machines in the Birmingham area.

A third company reportedly has reached an agreement with a well-known British builder to form jointly a new British company to make its machines over there.

A fourth company is now looking into the feasibility of manufacturing its machines in England.

A US builder of standard machines is offering in Canada its machines built in western Europe with a price tag competitive to machines of the same type offered by British and continental European builders.

Should Pentagon buy machines abroad? . . .

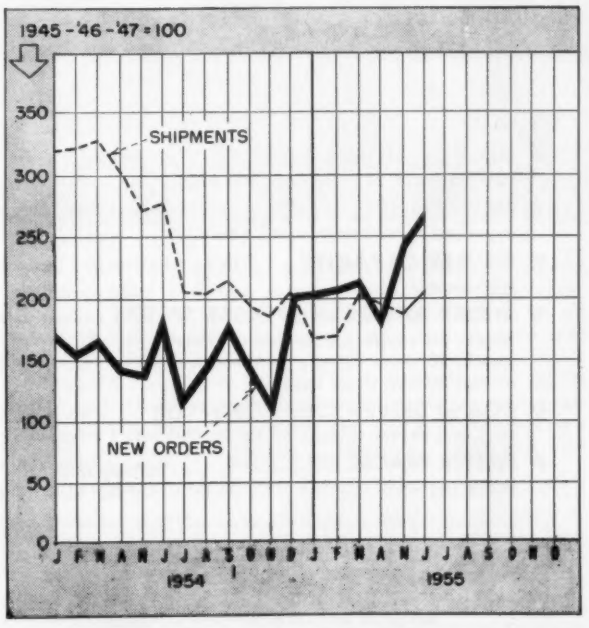
Defense Mobilizer Arthur Flemming has under advisement the question of whether it is "in the national interest," as some people think, for the armed services to restrict their machine tool purchases to American companies.

The issue has been raised by the decision of the Air Force to buy 45 radial drills from a British builder who underbid US companies.

Representations have been made to Dr Flemming that such purchases abroad weaken the machine tool industry here at home at a time when it is vital to keep it strong as a national defense measure.

Dr Flemming has the authority to set policy in a matter of this kind and Pentagon must follow it.

BF



MACHINE TOOL NEW ORDERS ARE AT 267.5 FOR JUNE on the National Machine Tool Builders' Association Index, continuing on the high plateau reached in May after a jump of 64 points index over April. Shipments showed a slight rise over May to 202.9 index, and were at about the same levels as for June 1954. Figures are preliminary, based on 78% of the machine-tool industry reporting.

AND NOW

A NEW

PRATT & WHITNEY

KELLER

AUTOMATIC
TRACER-CONTROLLED
MILLING

MACHINE

THE BL 3622 MODEL C

WITH THESE IMPORTANT *NEW FEATURES* . . .

- **HEAVIER, MORE RUGGED** . . . to take tough production schedules in stride day after day.
- **MORE POWER (10 hp)** . . . for increased metal removing capacity on today's tough new alloys.
- **BIGGER CAPACITY** . . . to handle larger, heavier workpieces.
- **WIDER RANGE of SPINDLE SPEEDS** . . . with a single, full-range spindle for all speeds . . . 30 to 3600 rpm in 20 steps. Spindle furnished with either No. 12 B&S or No. 50 MM taper bore.
- **POWER DRIVEN CHIP CONVEYOR** . . . no need to stop and shovel chips piled up by fast metal removal.
- **FASTER TRACER RESPONSE** . . . through a new electronic control of machine motions, travel speeds, and feeds.
- **PHENOLIC-TO-METAL BEARING SURFACES** . . . eliminate scoring of ways and preserve original high accuracy.
- **OPTIONAL RAPID TRAVERSE** . . . for vertical and horizontal movements.
- **ONE-SHOT LUBRICATION SYSTEM** . . . insures quick, positive thorough lubrication of all important sliding surfaces.

The NEW BL 3622, Model C is a powerful, horizontal spindle miller that reproduces the shape of any 2-dimensional template or 3-dimensional full model quickly and accurately. Complex or irregular dies, molds, prototypes and other workpieces that cannot be conveniently machined by any other method are handled as easily and economically as simple work. The Keller BL Machine is built ***specifically*** for tracer-controlled milling — not just "adapted". It is rugged, dependable, relatively simple . . . stays on the job year after year.

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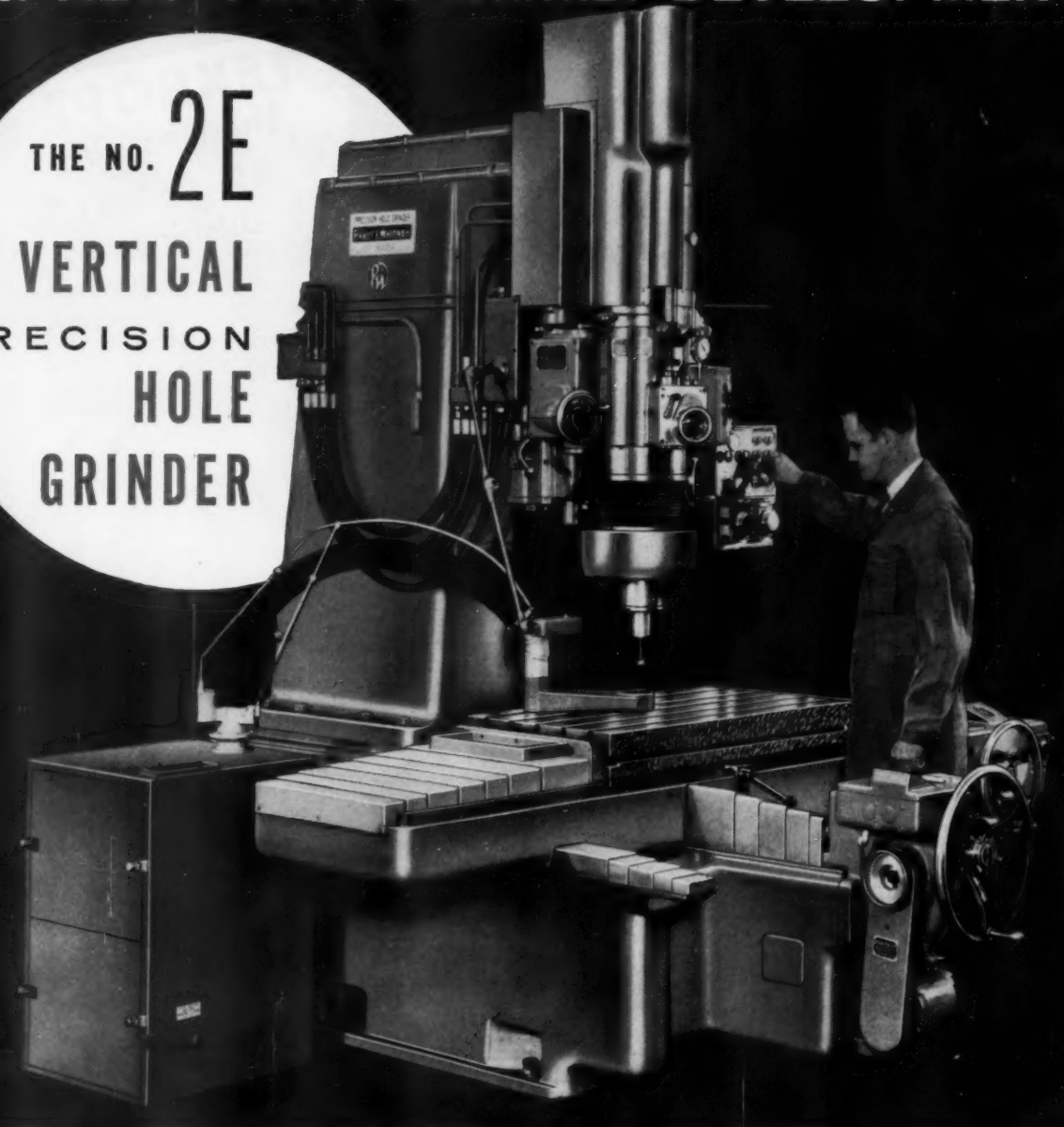
SEE IT AT THE SHOW; SPACE 1219.

FIRST CHOICE FOR ACCURACY SINCE 1860

MACHINE TOOLS • CUTTING TOOLS • GAGES

Another NEW PRATT & WHITNEY DEVELOPMENT

THE NO. 2E VERTICAL PRECISION HOLE GRINDER



- **EXTREMELY ACCURATE** . . . Incorporates the famous P & W Electrolimit Measuring System. Table settings accurate to .0001". Grinds straight or tapered holes and radii with extreme accuracy.
- **HIGH GRINDING SPEEDS** . . . Pneumatic grinding heads, of unique air bearing design, provide speeds from 4,000 to 100,000 rpm. Governor effectively maintains speed settings regardless of load changes.
- **FAST, SIMPLE, ECONOMICAL OPERATION** . . . Unlike conventional bore grinders, the 2E holds work stationary; grinding head has planetary motion around axis of hole. This — combined with fast, accurate table locating system — permits grinding holes of various sizes in a workpiece to close tolerances for size and location in a single setup. Controls for all machine motions within easy reach of operator. Time and costs are minimized.
- **VERSATILE** . . . Grinds holes up to 10" dia. Big table (22" x 44") with P&W open-side construction easily accommodates large or odd-shaped work. By adding a P&W Precision Rotary Table, any simple or compound angle can be located and ground without special fixtures.
- **DURABLE-DEPENDABLE** . . . All slide ways are protected by telescoping guards. Entire machine is designed and built to minimize wear and to retain its original high accuracy and rigidity year after year.

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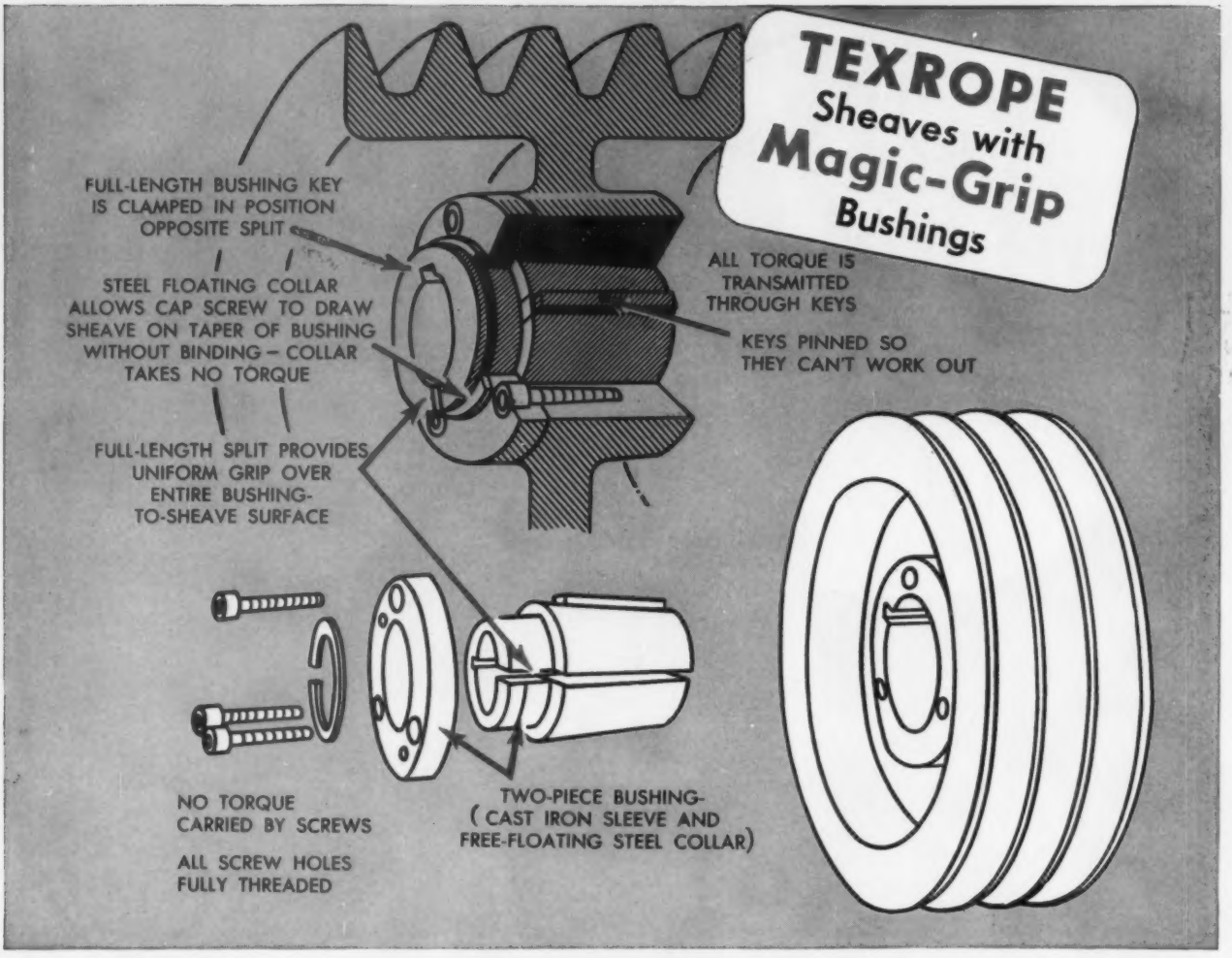
MACHINE TOOLS • CUTTING TOOLS • GAGES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Sheaves with
Magic-Grip
Bushings
FULL-LENGTH BUSHING KEY IS CLAMPED IN POSITION OPPOSITE SPLIT
STEEL FLOATING COLLAR ALLOWS CAP SCREW TO DRAW SHEAVE ON TAPER OF BUSHING WITHOUT BINDING – COLLAR TAKES NO TORQUE
FULL-LENGTH SPLIT PROVIDES UNIFORM GRIP OVER ENTIRE BUSHING-TO-SHEAVE SURFACE
ALL TORQUE IS TRANSMITTED THROUGH KEYS
KEYS PINNED SO THEY CAN'T WORK OUT
NO TORQUE CARRIED BY SCREWS
ALL SCREW HOLES FULLY THREADED
TWO-PIECE BUSHING- (CAST IRON SLEEVE AND FREE-FLOATING STEEL COLLAR)

Get the Only Sheave with ALL the Most Needed Features

Here's Comparison of *Magic-Grip* Sheave and Other Sheaves

	Magic-Grip Sheaves	SHEAVE A	SHEAVE B	SHEAVE C
Bushing fully split for uniform clamping action.	Yes	Yes	No	Yes
Load carried by keys instead of threaded bolts.	Yes	No	No	No
Bushings cover full range of NEMA "probable" shaft diameters.	Yes	Yes	Yes	No
All screws engage full thread.	Yes	Yes	Yes	No
Mounts in one piece.	Yes	No	Yes	Yes
Squares itself with shaft.	Yes	No	No	No

A-4167

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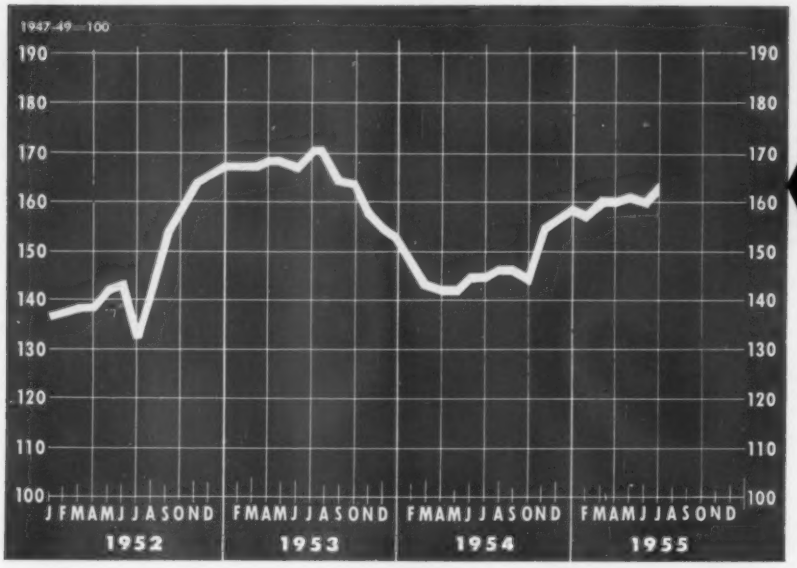
Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	JULY Estimated	JUNE Preliminary	MAY Revised	JUNE Year Ago
Total index	**163**	**163**	**162**	**146**
Machinery	**136**	**134**	**123**	
Electrical Machinery	**187**	**184**	**173**	
Autos	**143**	**157**	**102**	
Other Transportation	**286**	**278**	**284**	
Other Metalworking	**138**	**135**	**125**	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

July is bigger month than June . . .

Metalworking production is defying the hot weather and seasonal influences to maintain a breath-taking pace for peacetime.

In July, vacation shutdowns and heat usually take a heavy toll which is reflected in slackened output. But this year things are different.

American Machinist Production Index is estimated at 163 for July. That makes July the best month since the upswing began in the final quarter of '54.

The index thus is within 8 points of the post-Korean peak in 1953, when defense work contributed strongly to metalworking operations.

The fact is worth noting that the 1953 top point was reached in the summer months of July and August.

Like the present situation, conditions then were contrary to the usual seasonal trend.

Auto industry still a leader . . .

Metalworking still derives its greatest support from the automobile industry. Electrical machinery manufacture also is well above that of a year ago.

Products as far apart as household appliances and industrial machinery are in the midst of a boom, or a near-boom.

The aircraft industry is struggling to hold its own as against last year's record. Reports from plane makers and parts companies tell a consistent story of pulling back work from subcontractors.

Still, the year's performance will be very good. The recent burst of orders for railroad freight cars is likely to give the false impression that car builders are over their troubles.

Freight car output to be better . . .

Truth is that the freight car industry is going along at about 35% because orders arrived too late to get steel booked for third quarter delivery. And builders are not optimistic about receiving anywhere near the amount of steel in the fourth quarter that they would like to have.

Next year, however, will be a different story. Electro-Motive's scouring of the Chicago area for 650 skilled workers to meet the substantial gain in orders for diesel-electric locomotives and parts is typical of the resurgence in the railroad equipment field.

Farm implement business is on the mend. Tractor sales, in particular, have been good. Industrial power equipment demand too has been excellent in recent weeks.

Stamping plants doing well . . .

Commercial stamping plants have felt no letdown in orders from Detroit. But they are taking a little less steel in anticipation of a drop-off around the middle of August. Orders from makers of appliances, radio sets and TV units are way ahead of last year. And no decline is in sight.

. . . and tools and dies are better . . .

Tool and die shops report shipments on the rise but the increase has been less than the industry expected for this time of year.

New orders for tool and dies are gaining but backlog still is below that of a year ago. Los Angeles is the best spot in the nation. Shops polled on the outlook report: 12% saying it is excellent, 49% good, 35% fair, 4% poor.

Gaging Business . . .

Price Index

	JULY Esti-mated	JUNE Pre-liminary	MAY Re-vised	JUNE Year Ago
Total Index	**135.5**	**135.0**	**134.7**	**132.5**
Metalworking Machinery	**152.0**	**149.0**	**141.6**	
Other Machinery exc. Electrical	**139.7**	**139.5**	**137.5**	
Electrical Machinery	**131.7**	**131.7**	**131.1**	
Fabricated Metal Products	**130.8**	**130.8**	**128.7**	

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

Industrial output rose to an all-time peak in June. Federal Reserve Board index stood at 139, or 1 point higher than in May.

Production in June was 12% above that in the same month of last year. The increase came in non-durable goods and in minerals, not in durable goods, which stayed at the May level.

Gross National Product is now running at an annual rate of more than $380 billion. U S Department of Commerce statisticians have recently completed revisions of GNP figures back as far as 1952. They show, incidentally, that the 1953-1954 recession was not as deep as earlier estimates suggested.

The actual decline, from the peak second quarter in 1953 to the low point in 1954, was only 3%.

Inventories have been going up this year. They are now about $2 billion higher than at the year's start.

They were around $77 billion at the beginning of 1955 and today are nearly $79 billion.

The gain of $4 billion this year (figured on an annual basis) is just about normal for a year in which business activity will average more than $380 billion.

Inventories rose $600 million in May alone. Much of the gain is believed to be in steel and automobiles.

The inventory-to-sales ratio, even at current levels, is not out of line with past performance. Reason:

Manufacturers' sales, as well as wholesale and retail trade, are setting a new record.

Keep in mind this possibility: If sales do not keep up with anticipated increases in inventories the next few months, a period of inventory adjustment is certain.

A considerable part of the addition to stocks of goods on hand has come from the desire of manufacturers to beat price advances.

Government price indices are begining to reflect recent price increases. In one month the wholesale price index of industrial materials (all commodities excluding farm and food products) has risen one-half of one percent.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949 = 100)*	144.7	143.5	125.4
Steel ingot operation (thousands of tons)	2,276	2,202	1,557
Electric power output (million Kilowatt hours)	10,440	9,759	8,951
Production of automobiles and trucks	206,708	167,288	130,757
Engineering construction awards (*Eng. News-Record*—millions)	$360.7	$578.4	$259.3

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949 = 100)*	139	138	124
Index of durable manufactures production (1947-1949 = 100)*	153	153	135
Durable goods manufacturers' sales, millions*	$13,275	$12,805	$11,066
Machinery manufacturers' sales, millions*	$3,396	$3,193	$3,131
Durable goods manufacturers' new orders, millions	$14,411	$12,879	$9,588
Machinery manufacturers' new orders, millions	$3,503	$3,179	$2,526

*Seasonally adjusted

"AMERICANS" WORKING FOR NORDBERG

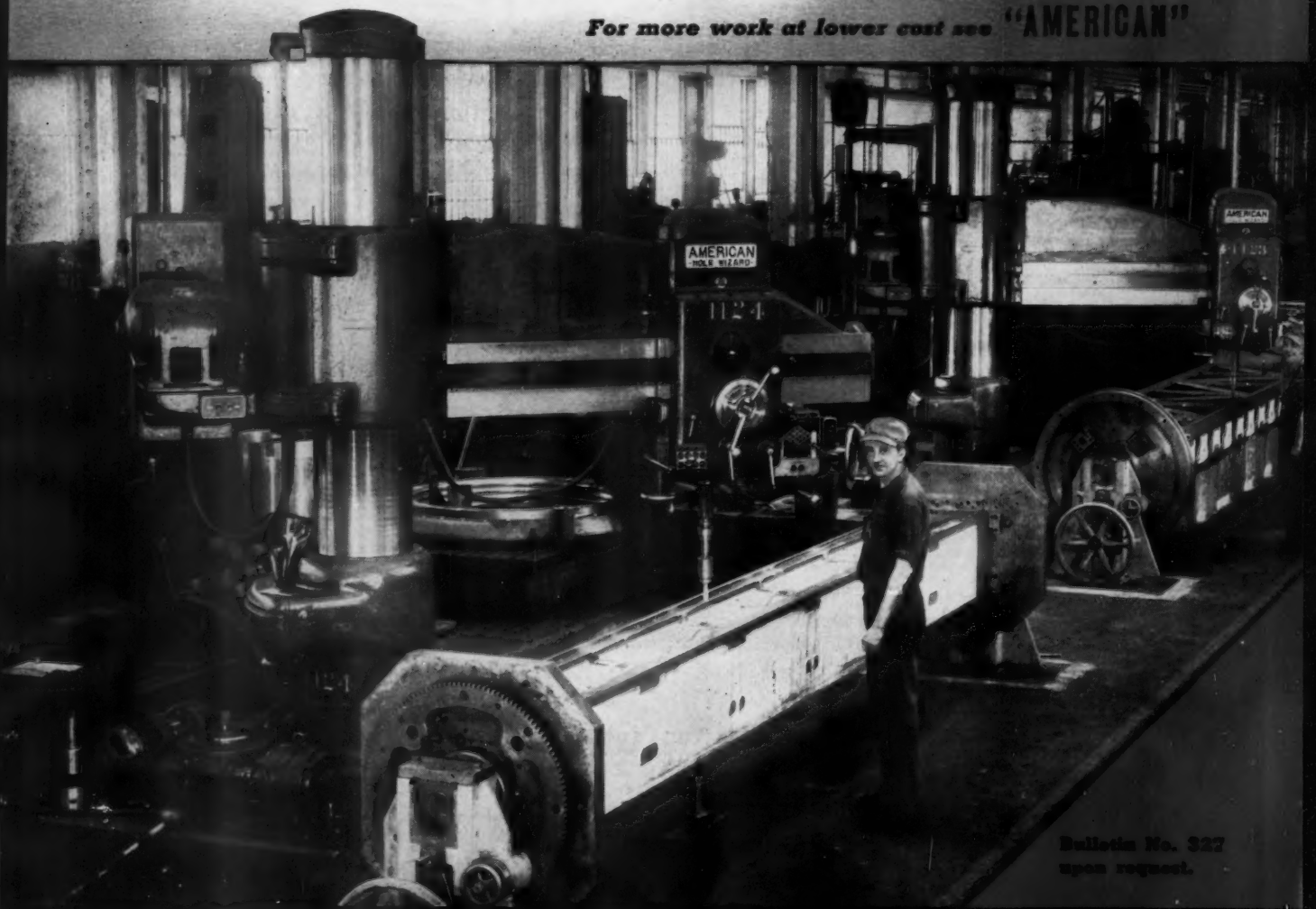
helping to profitably produce the quality products for which Nordberg Manufacturing Company of Milwaukee, Wisconsin is known the world over.

These "AMERICAN" Track Type Hole Wizard Radials mounted on mobile bases speed up drilling, tapping and boring operations in long, heavy work pieces by bringing the tool to the work rather than moving the work to the tool.

The work pieces are mounted in elaborate trunnion jig fixtures so different work planes may quickly be presented to the tool and a high degree of accuracy maintained.

The quality of Nordberg products is universally recognized. We are proud indeed that so many "AMERICAN" Lathes and Radial Drills contribute to it.

For more work at lower cost see "AMERICAN"

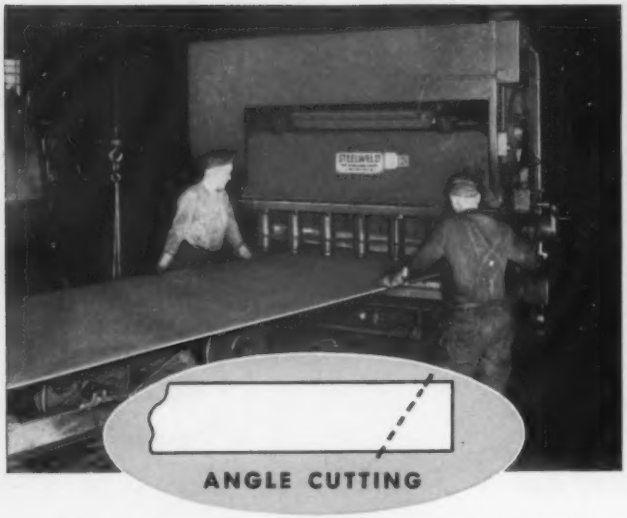


Bulletin No. 327 upon request.

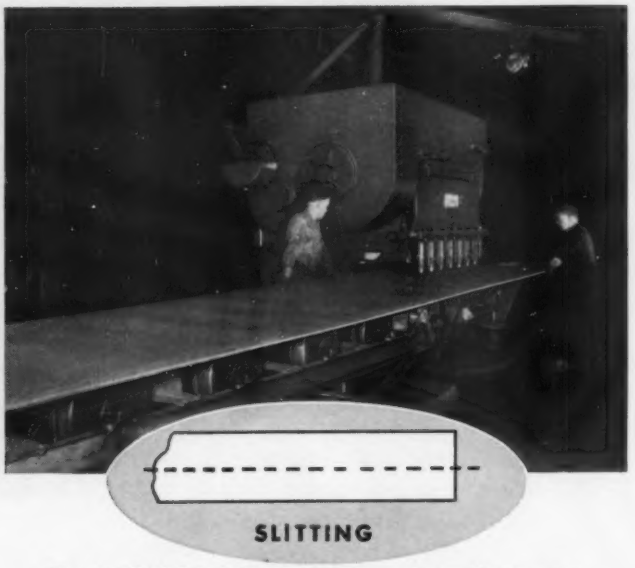
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

Here's a **VERSATILE SHEAR** that *Speeds Production*



Because of the deep throat in end housings, larger size sheets or plate can be cut at various angles than possible with most shears. This is also a great advantage when notching and slitting.



The standard 24" throat depth permits slitting sheets up to 48" wide on any line. 36" throats are also available for larger machines.

SQUARE or angle cut, slit or notch any can be made quickly on a Steelweld Shear.

Not only will Steelwelds handle every kind of cut, but they are provided with unusual features that make their operation easier and faster and assure accuracy.

Send for the catalog below. Learn why Steelweld Shears are the most outstanding on the market today.

Steelweld Shears operate on the widely acclaimed pivoted-blade principle. Shear action is controlled by electric foot switch. Machines for making cuts up to 24'-0" are now in service.

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CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1437 EAST 282nd STREET, WICKLIFFE, OHIO

STEELWELD PIVOTED BLADE SHEARS

American Machinist

MAGAZINE OF METALWORKING PRODUCTION * ESTABLISHED 1877

The "Work Horses" Are a New Breed

It is the spectacular happening that makes the front page. Any new nuclear development that threatens to blow the world to smithereens gets a splash headline. On the other hand, an announcement that nuclear power is being used for the first time by a housewife in her kitchen to fry eggs is lucky to land on page ten.

Similarly, an automated production line which turns out 1000 widgets an hour with virtually no workers around fascinates the crowd and is a publicity "natural." By contrast, a shop with a lot of standard machine tools and a sizable work force is pretty much taken for granted and gets only casual recognition at best.

All of which is preliminary to making this observation: **Let's not make the mistake of allowing the big dramatic developments in production equipment, as interesting and as important as they are, overshadow completely what's going on in standard machine tools.**

Most of the cutting and forming of metal products is being done on so-called "bread-and-butter" general-purpose machines—and let's not forget it. And this will be the case for a long time to come, even after due allowance is made for all the "specials" now on the market or in the developmental stage.

America's metalworking industries consist mostly of thousands and thousands of small shops and medium-size plants. Mass production, as Detroit thinks of it, is unknown to these companies. Their output is comprised of small lots. They are essentially job shops to which the mass-production technique can be applied only to a limited extent if at all.

This does not mean that they are doomed to use methods or machines dating back to prewar days. Quite the contrary. The up-to-date small shop of 1955 is just as different from the small shop of 1940 as Ford's Cleveland engine plant differs from the River Rouge engine plant of the 1930's.

More than that, **standard machine tools, 1955 style and design, bear little resemblance to standard machine tools, 1939 style and design. Anyone who believes that they do hasn't seen the improvements that machine tool builders have made in their general-purpose machines.**

Take the 1955 machine of a well-known builder. It is a new machine from the floor up. It produces 60% more work than the model it replaced. It has flexibility and versatility; it has 18 high speeds with each of which any of 13 low speeds can be used. It has push-button control of both spindle and drive-shaft speeds. Chip area has been doubled. Spindle speed now goes up to 7195 rpm in preloaded bearings. Eleven change gears replace the former 62. There are other improvements too numerous to mention here.

What one builder has done in completely redesigning his standard machine is typical of what others have done and are doing. These new machines are making it unprofitable and downright precarious for metalworking shops all round the country to continue to work with obsolete machines.

The latest in standard machine tools will be on exhibition at the Machine Tool Show in Chicago in September. Be sure to spend plenty of time looking them over. You will be a wiser and better production man for it.

Burnham Finney

50 lbs. oil pressure

IS NECESSARY WITH A CUT LIKE THIS...

Demonstration cut.
Actual size steel chip. 2" cut .030" feed.

This tremendous cut demonstrates the extra strength, rigidity, and power in Cincinnati Shapers. It also demonstrates the ability of the 50 p.s.i. lubrication system to develop and maintain oil films under the heaviest loads.

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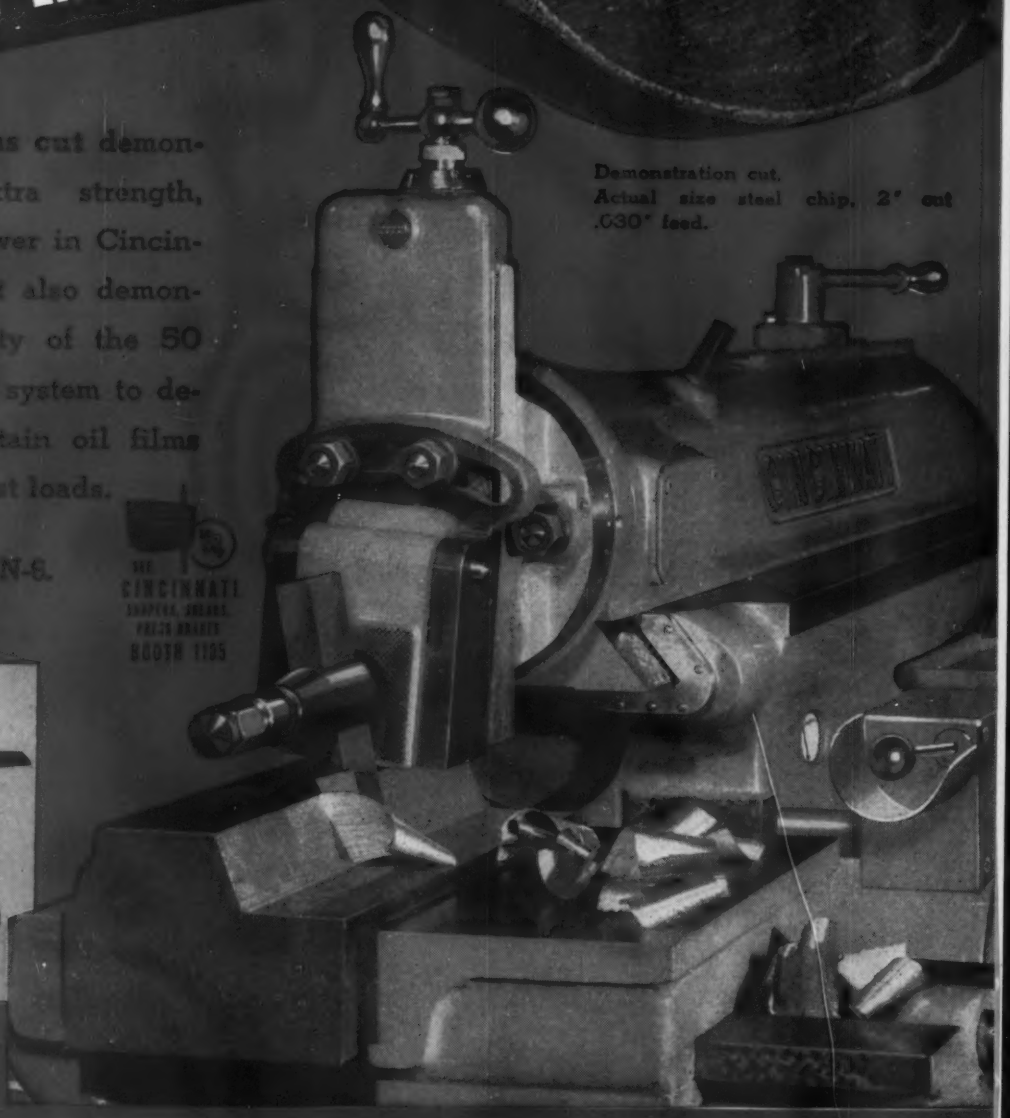
50 p.s.i. system includes 50 micro filter, settling basin and reservoir. Transmission runs submerged in oil.



CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

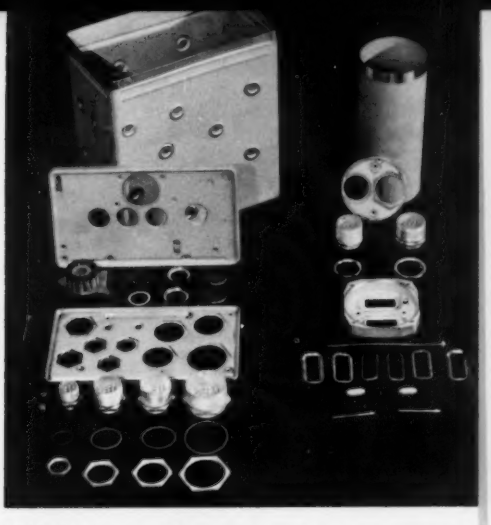
"Iron"
Hot-plate
Infra-red
Oven
Dip
Torch
Resistance
Induction

Eight techniques to improve soldered assemblies

Soldering can be a very simple and routine operation, or it can be an extremely complicated problem. In either case, careful planning and tooling will be as beneficial as they are in other production operations. All methods described in this article are used to produce one assembly. However, each method has wide application in the manufacture of other items.

Ford Instrument Co makes an aircraft ground-position indicator, used in navigation, which contains many minute and precise gear trains and highly polished bearing surfaces, which might deteriorate if exposed to air. These units are hermetically sealed in nickel-plated aluminum cases, to reduce weight, and the cases are filled with an inert gas. Solder is used to join and seal the cases.

GERARD OLSEN, foreman, Wiring,
FORD INSTRUMENT CO, DIV OF SPERRY RAND CORP, LONG ISLAND CITY, NY



SOLDER joins all of these components to form cases and c for three of the four units that comprise the GPI equipm hermetically sealed. All aluminum parts to be soldered ar shapes and sizes suggests leakage problem that must be ov

FELT APPLICATORS for pretinning are turned on a lathe fr wheels to fit various holes to be tinned. Most applicator more diameters, hence the stepped appearance. Tinning co of solder plus a flux which becomes a paste having the c Applicator shank is held with the fingers and felt is dippe is brushed on, then inserted in hole and rotated to leave just where tinning is required

SPECIAL ADVANTAGE in pretinning small holes with app pound is not deposited in difficult-to-reach places. Agair contour of hole and, for this size, a knob is placed on shar brush is used to touch up areas missed by applicator

ERING TECHNIQUES (continued)

done on small, plated-brass bellows using 50-50 solder. ui to control depth of solder on each end. If solder gets ecome inactive and restrict bellows motion. Part is placed . (Bellows permits transmission of motion into or out of

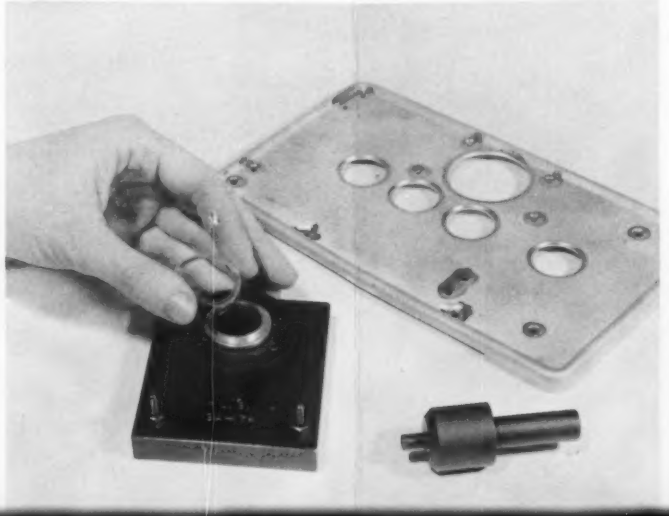
300-WATT IRON AND TIP designed to pass screwdriver through its center permits tightening screw as solder melts. Windows are previously soldered with a higher-melting-point 50-50 solder, and water is placed on the glass while screws are sealed with 60-40 solder preforms. Temperature control is very important as assembly progresses. Solder washer under each screwhead protects nickel plate from chafing; insures perfect seal

PILOTED TIP is used to exactly positio joining delicate deviation cam to top cov soldered with 50-50 solder; now 60-40 s temperature. Again, water is placed on Special tips are machined to exact dime operation for more dependable performa

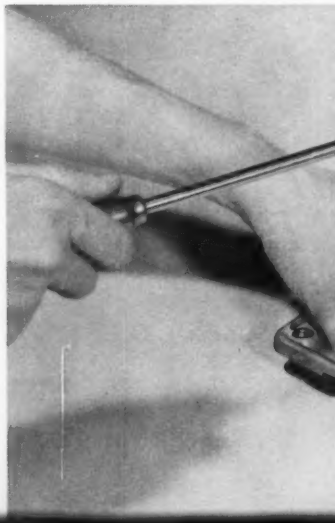
ed temperature (800 F) that permits visual inspection and needed. Assembly is placed on plate after oven solder- der is added if necessary. Then part is turned over on f solder are placed on each nut that holds connector to ut against loosening from vibration

INFRA-RED LAMPS, in two banks of four, solder 12 bellows to an adapter simultaneously. This method allows visual inspection plus controlled temperature, by varying the distance of the upper and lower banks of lamps. Bellows are tinned, flared, seated in adapter, and fluxed prior to soldering. 50-50 solder preforms assure adequate solder, uniform joining, and a high-temperature joint that will withstand a later 60-40 soldering of unit to case

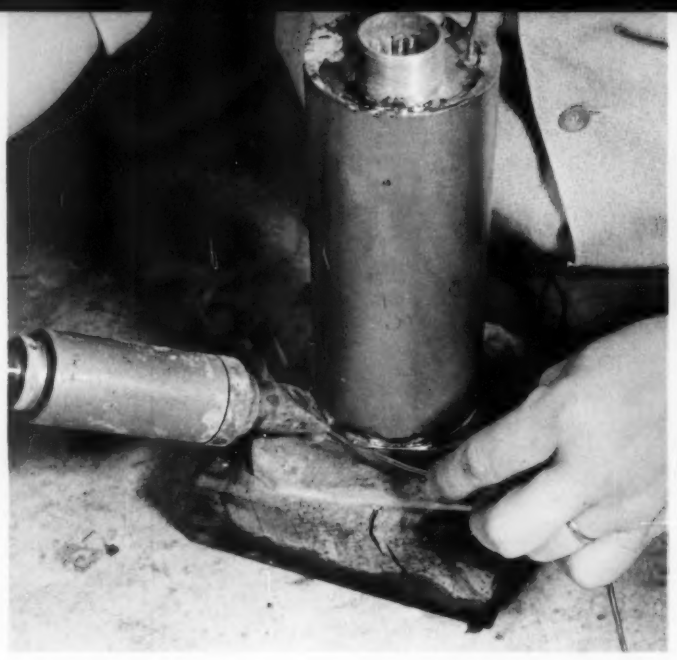
GAS-AIR FLAME silver-solders copper t is threaded into nut. This assembly, in to provide the inlet used to fill the herm filling, tube is crimped and soldered to se



Invar bezel, used to hold glass window, to top cover of ced on die, aluminum spacer (in man's hand) is placed placed over these two. Piloted flaring tool is inserted and ch rolls edge of bezel over lip of hole in plate. Then as- 50-50 preform. Aluminum spacer is *not* tinned, to permit xibility of bezel. Studs in die block provide three-point parallel, and prevent rocking



position 300-watt iron over solder preform in top cover of computer. Cam, for assembly, was 60-40 solder is used to permit joining at lower ced on windows to prevent damage from heat. t dimensions of parts to be sealed, standardize erformance



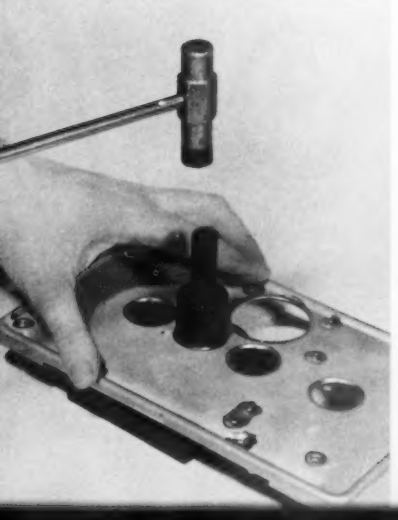
WET-FELT PAD, on wooden block, keeps heat from two windows previously soldered into top-cover assembly with 50-50 solder as top cover and body tube are joined with 60-40 wire solder by conventional method

WOODEN FIXTURE supports top-heavy unit in ve are sealed. Proper holding and positioning for in intricate soldering operations

opper tube to hexagonal brass nut, after tube bly, in turn, is soft-soldered to instrument case he hermetically sealed unit with inert gas. After ed to seal the unit permanently

RESISTANCE SOLDERING of studs to bellows is done with a plier-like device controlled by a MicroSwitch trigger in its handle. Carbon-electrode tips are clamped on part to be soldered and trigger is squeezed. Electrical resistance causes part to heat and wire solder is applied. Method is fast; uses safe, low, voltage and high current, yet it provides excellent control of heat for soldering delicate assemblies

ASSEMBLY FIXTURE assures getting part in pro Colored dots on fixture show relationship of key t portion of connector for tightening nuts after pl top of fixture. Device is made by attaching a th hex holes to a milled-out block of heavier sto prevents mechanical abrasion of nickel plate



Induction Unsoldering

For repair and inspection of components after testing, it is important to be able to unsolder these assemblies. Rapid dissipation of heat away from the immediate area of the iron allows the solder to cool before a part can be removed. Molten solder is difficult to control and there is a danger that it will damage delicate mechanisms.

Working with Induction Heating Corp, we developed shaped coils to fit each end of each case, cooling jackets to match—circular and r kva induction unit operates at 400 kc, wi intermittent heating cycles as continu damage mechanism. When temperature pre-set dial, power is shut off instantly. U in seconds.

More on this subject—
Nickel-plating aluminum AM-June 7'54, p154
Induction solder assembly AM-June 21'54, p117

Hot-plate

Dip

Torch

Induction

t techniques

nprove

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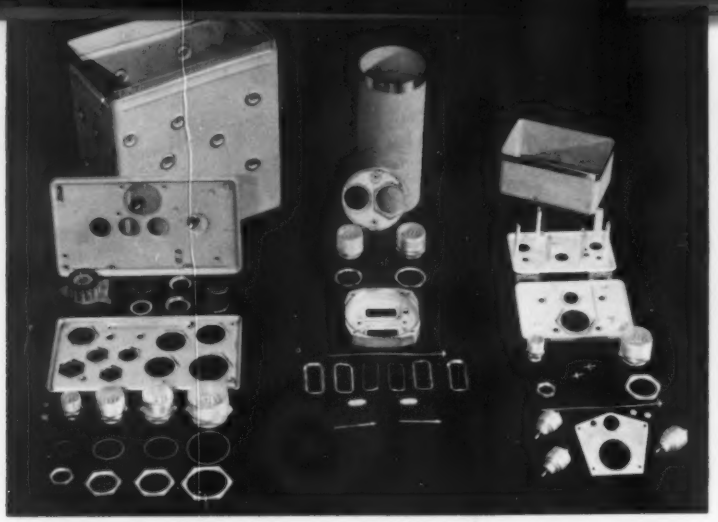
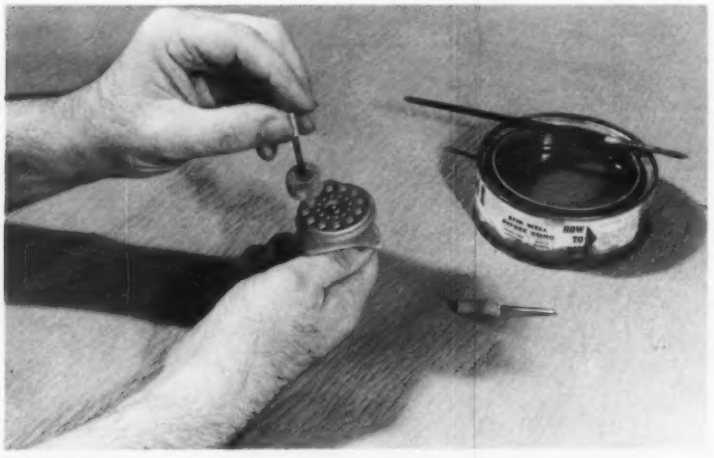


SOLDER joins all of these components to form cases and external wiring connections for three of the four units that comprise the GPI equipment. The fourth unit is not hermetically sealed. All aluminum parts to be soldered are nickel plated. Variety of shapes and sizes suggests leakage problem that must be overcome

INTRICATE CAM ASSEMBLY con
All parts are pretinned, and solde
simultaneously solders all 12 bell
resistance soldered to opposite end

FELT APPLICATORS for pretinning are turned on a lathe from mounted felt polishing wheels to fit various holes to be tinned. Most applicators are turned to fit two or more diameters, hence the stepped appearance. Tinning compound is a powder form of solder plus a flux which becomes a paste having the consistency of heavy paint. Applicator shank is held with the fingers and felt is dipped into the paste, or paste is brushed on, then inserted in hole and rotated to leave a neat ring of compound just where tinning is required

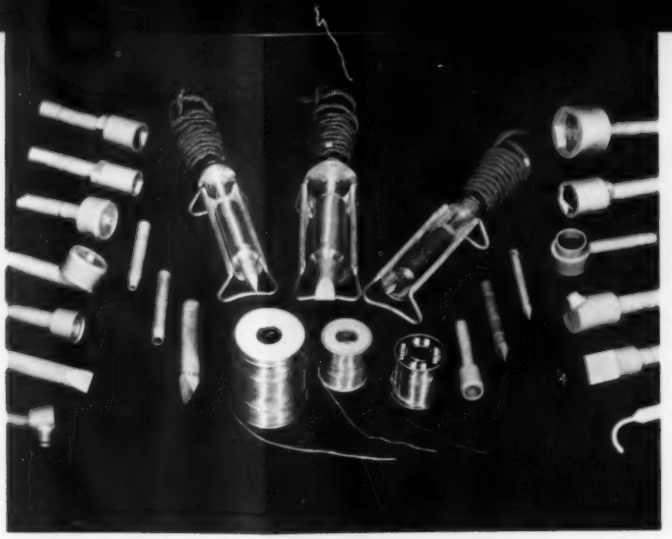
FOR PRETINNING EDGES, one a
bearing and is used as shown. Thi
amount and location of tinning;
applicators are contoured to fit dim



SPECIAL ADVANTAGE in pretinning small holes with applicator is that excess compound is not deposited in difficult-to-reach places. Again, applicator is shaped to contour of hole and, for this size, a knob is placed on shank to ease twirling. Artist's brush is used to touch up areas missed by applicator

FELT-BLOCK APPLICATOR is mad
with felt and swabbing tinning co
to provide an even stripe of com
simultaneously—meanwhile keepin

LY consists of adapter, bellows, studs, bushings, ring. d solder preforms speed assembly. An infra-red heater 12 bellows to the adapter. Each stud is individually site end of each bellows



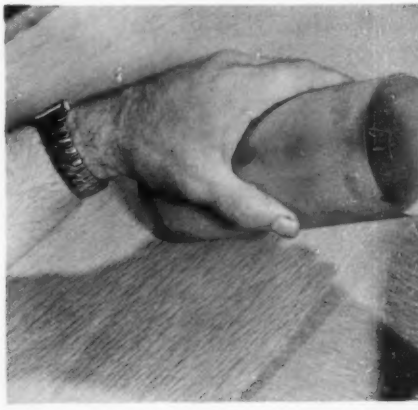
NICKEL-PLATED-COPPER TIPS are especially shaped for each task. 22 of the 30 different shapes required are shown. All tips of two-piece construction are silver soldered. Three "irons", rated at 100, 200, and 300 watts, are used with these tips and, for most operations, wire-solder preforms fit specific contours. Wire solder is of different diameters, with varying rosin cores, selected to suit the size of the joint. Measuring solder quantity simplifies control

Solder specification

A tight, leakproof, solder seal, h ant and able to withstand norm ditions found at 50,000-ft altitude from –54C to + 71C. Total we entire GPI equipment must not 1.4 cu ft

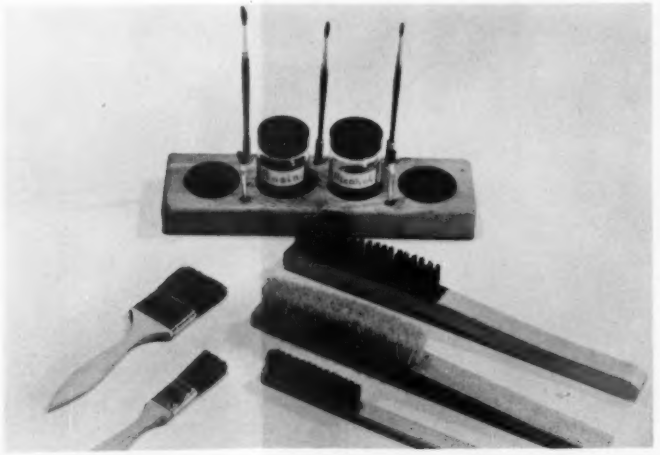
one applicator is equipped with a handle and ball wn. This has proved fast and effective for controlling inning; coats face and edge simultaneously. Other fit dimples and window areas

ACTUAL TINNING is done in oven at 500F. After applying compound, parts are placed in oven until bright shine of molten solder replaces dull look of paste compound. After tinning, part is rinsed twice in water at 140F to prepare it for actual soldering, which is done with rosin-alcohol flux. Oven provides fast, uniform, and controlled-temperature process



FIBERGLAS BRUSH, with a revolving disk to contr applying tinning compound in narrow stripe arou

is made by boring hole in wood block, then lining it ing compound on felt. End of tube is rotated in block of compound on both the end and the outer edge keeping inner edge clean



AFTER TINNING, brushes and hot water scrub off excess flux, then artist's brushes apply rosin flux for actual soldering. After final soldering and hermetic sealing, components are brushed clean of rosin with acetone, then alcohol

SPECIAL TIP on soldering iron is shaped to fuse acorn nuts and 12 screws to top cover of unit. Beca provided in its side; otherwise hot gases would f joint

EIGHT SOLDERING TECHNIQUES (continued)

DIP-POT TINNING is done on small, plated-brass bellows using 50-50 solder. Operator must be careful to control depth of solder on each end. If solder gets into corrugations they become inactive and restrict bellows motion. Part is placed on mandrel for dipping. (Bellows permits transmission of motion into or out of hermetically sealed unit)

300-WATT IRON AND TIP designed to
permits tightening screw as solder melts. W
a higher-melting-point 50-50 solder, and
screws are sealed with 60-40 solder prefor
portant as assembly progresses. Solder wa
nickel plate from chafing; insures perfect sea

HOT PLATE has controlled temperature (800 F) that permits visual inspection and any additions of solder needed. Assembly is placed on plate after oven soldering, inspected, and solder is added if necessary. Then part is turned over on plate and three tacks of solder are placed on each nut that holds connector to cover. Tacking safeties nut against loosening from vibration

INFRA-RED LAMPS, in two banks of four
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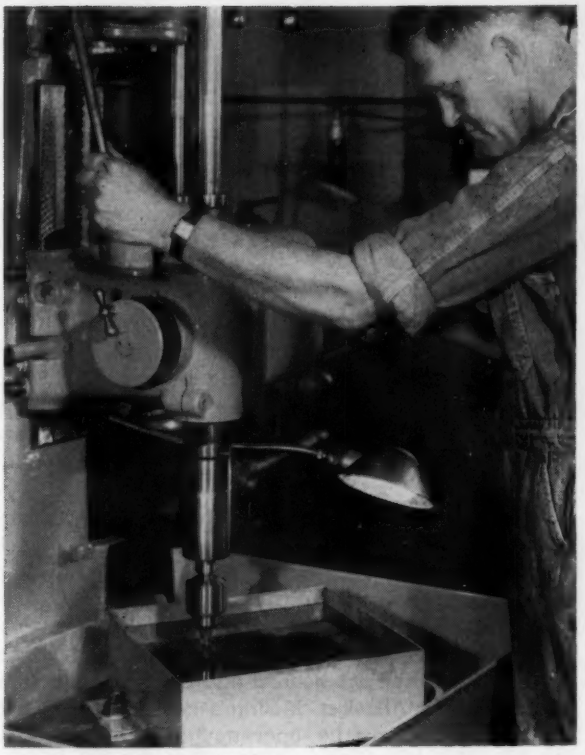
FLARING TOOL flares Invar bezel, used to hold glass window, to top cover of instrument. Bezel is placed on die, aluminum spacer (in man's hand) is placed on bezel, and plate is placed over these two. Piloted flaring tool is inserted and rapped with mallet which rolls edge of bezel over lip of hole in plate. Then assembly is soldered with 50-50 preform. Aluminum spacer is *not* tinned, to permit free movement and flexibility of bezel. Studs in die block provide three-point suspension, keep plate parallel, and prevent rocking

HOW TO MACHINE URANIUM

Except for drilling and tapping of small holes, uranium is no longer the most challenging of metals to machine. Here, in the first article released on the subject by the AEC, Argonne experts show what to do



DRILLING UNDER WATER provides a continuous supply of coolant and prevents ignition of uranium chips. The drill should be short, sharp, and under heaviest possible feed

ALEXANDER DENST, foreman, Central Shops, and H V ROSS, superintendent, Central Shops
ARGONNE NATIONAL LABORATORY, LEMONT, ILLINOIS

URANIUM CAN BE HACKSAWED with a backing strip above the blade for additional strength. Moly or tungsten HSS blades are used, preferably with 4 tpi. A heavy-duty power saw, with its original 2-hp motor replaced by a 5-hp one, cuts unalloyed uranium best at 100 to 150 strokes per min, and feed of about 0.020 in. per stroke

At one time, the machining of uranium was presumed to be a drill-busting, lathe-breaking, tap-smashing, saw-shattering business — the toughest nut of metals to crack. It isn't any more.

As a result of months of exploratory effort at Argonne National Laboratory*, where experimental research rather than mass production is the objective, uranium can now be machined, for the most part, by mass-production methods at reasonable costs. With the exception of drilling and tapping small holes, uranium is no longer the most challenging of metals to machine. It is, nevertheless, unlike other metals and presents its own special problems.

Initially, it was thought that it would be difficult if not impossible to speed up the machining of uranium. Mass-production methods were believed impracticable, because even a simple operation such as drilling was costly and tedious, for drills required resharpening after drilling to a depth of ¼ to ½ in. As one example, drilling a 1-in. hole through a 4-in. block of uranium required approximately three hours.

As a result of the efforts of Russel Anderson, Leo Franck, Carl Munter and other instrument makers of Central Shops, improved methods of machining

Operated by the University of Chicago for the US Atomic Energy Commission

were devised with the result that today such a hole can be drilled in 2½ minutes.

The normal or unalloyed uranium machined at Argonne ranges in hardness from R_B 90 to R_c 30 and has an ultimate tensile strength of 80,000 to 100,000 psi. Machining presents a minor hazard because of uranium's pyrophoric properties; it presents a minor problem because of variations in machinability from impurities or alloying elements, but the major factor with which to contend is uranium's almost instantaneous work-hardening. The slightest tool disturbance renders it adamant and almost unworkable.

Power is the key to machining uranium; hand drilling or hand feeding should be considered out of the question. The technique demands a fast, heavy cut so surface metal may be removed before it has an opportunity to work-harden. Machines for cutting off, milling and drilling must be of a heavy-duty type with a positive feed and must be maintained in excellent working condition with no slack in the feeding mechanism. Normally, the heavy, rigid, high-power machines best suited to utilize carbide tooling are ideal for machining uranium.

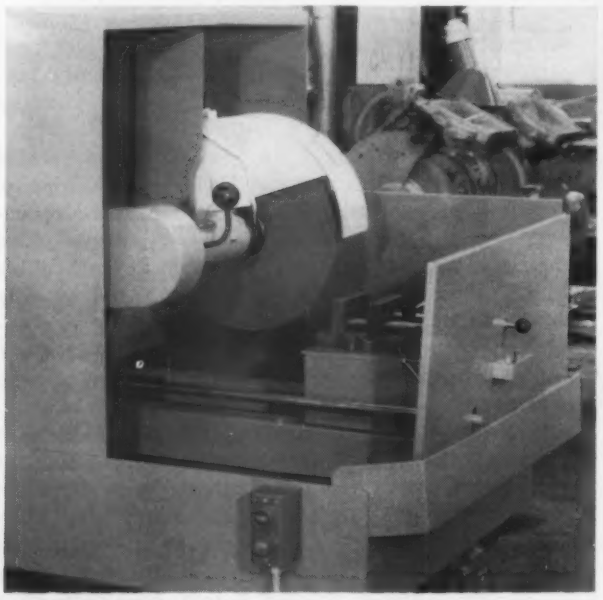
At Argonne National Laboratory, the machines used for uranium are hooded and utilize a Rotoclone system for ventilation. Machine hoods, so designed as not to hinder the operator, are connected to ducts exhausting with a velocity of 4000 fpm (See *AM*, July 4 '55, p125).

DRILLING—A power feed is the first requirement. Drilling can be satisfactorily performed on a drillpress, on a mill, or in a lathe. A mill is considered somewhat more versatile, although a drillpress with an outboard support is suitable, as is the lathe when the drill is mounted on the carriage and power fed. A typical drilling operation at Argonne on a large drillpress showed the following results with an 0.209-in. HSS drill in ½-in. uranium plate:

Speed, rpm	590	1000	1500
Feed, ipr	0.004	0.004	0.004
Results	Poor	Good	Very Good

At 1500 rpm, it was necessary to resharpen the drill at intervals of 15 to 20 holes. No apparent difference was observed when the drilling was repeated using water and oil in turn. Further tests were carried out at the same speed (1500 rpm, or 80 fpm peripheral speed) using feeds ranging up to 0.025 ipr. In all cases the heavier feeds produced equally good results although the drill had to be cut short (protruding one inch out of the chuck) when the heavier feeds were used. In general, drilling should be performed at peripheral speeds of from 80 to 125 fpm with as heavy a feed as drill strength, machine rigidity and desired hole finish will permit. A feed of 0.004 should be considered a minimum to insure cutting under the previously disturbed surfaces.

DRILLING SMALL HOLES—Drilling holes less than ⅛ in. in dia presents a special problem. The amount of thrust on the drill necessary to achieve required feeds is in excess of the drill capacity. The result of a heavy feed is a succession of broken drills. The only practical method thus far discovered has been to begin drilling with ten or twelve



ALLOYED URANIUM is sometimes almost impossible to saw. Then abrasive cutoff wheels are highly satisfactory; the thin wheel wastes less metal in the kerf than a sawblade and gives a finer finish. The wheel must be soft, of the "self-dressing" variety, so it breaks down and continues to cut. Ours are 14 in. in dia, 1/16 in. thick, and 120 grain. A mixture of oil and water must be used, as always, to aid cutting and reduce fire hazard from the finely divided pyrophoric particles

TURNING requires a rigid, powerful lathe tooled with carbide. In turning bars, a small plastic hood is used to simplify chip collection (see *AM*, Mar 28 '55, cover and p138)

drills at hand and to drill a maximum of 1/32 in. with each drill, resharpening the set as needed. Drills must be as short as possible to reduce their flexibility. Using this method, holes of 0.049-in. dia have been drilled 2 in. deep. This procedure is time-consuming, but the expense is less than when the drills are pushed to the breaking point.

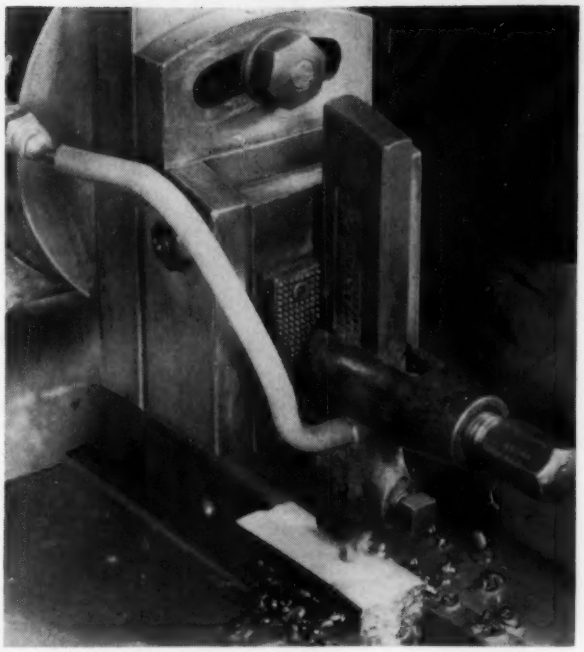
TAPPING—Tapping is not subject to the same degree of control as is drilling because tap rotary speed and coolant are the only variables which can normally be changed. In tests using ¼-20 taps in 0.209-in.-dia holes through ⅜-in. uranium plate, it was found that 2-flute gun taps were more satisfactory than 3- or 4-flute taps, which consistently broke. Using oil as a lubricant, tapping was performed at speeds of 50, 175, 540, 1000 and 1500 rpm. No satisfactory threads were produced, and tap breakage was excessive. However, when molybdenum disulphide was used as the lubricant, satisfactory tapped holes were produced at 75, 235 and 540 rpm, with best tap life at 540 rpm. It is essential that taps be kept sharp, particularly when tapping smaller holes.

CENTERLESS GRINDING—A highly satisfactory method of stock removal on uranium and a routine process now that a wheel of proper characteristics has been selected. Following tests with various combinations of abrasives, grain sizes, grades, structures and bond, it was found that a vitrified silicon-carbide wheel with 46 grain size, K hardness and 5 density performs the best at a workpiece peripheral speed of 70 fpm. Diamond dressers wear rapidly with this type of wheel, but it is felt that the end result economically justifies its use. Two precautions should be observed in the use of the centerless grinder: (1) a heavy and unfailing supply of water must flood the work, not only to aid the cutting, but also to completely drench all the finely divided particles of uranium which would immediately ignite if the water failed, (2) any bars to be ground must be well supported at the ends because the weight of uranium, 0.68 lb per cu in., is approximately 2½ times that of steel.

TURNING—Readily performed if the lathe is sturdy and adequately powered. Carbide tools should be used and tests at Argonne indicate that the rate of turning can be quite high if short tool life is acceptable. For example, cuts have been made ¼ in. deep with a feed of 0.062 ipr at a surface speed of 500 fpm. This is not recommended, however, for in addition to the problem of very short tool life, the extreme heat generated in the chips creates a fire hazard. Turning tests at Argonne covered combinations of surface speeds up to 500 fpm, feeds from 0.008 to 0.062 ipr, depths of cut from 0.060 to 0.250 in., and various cutting angles.

These tests revealed that best tool performance was achieved when carbide tools were used with a 7° effective rake angle, 6° side and front clearance angles, and a point radius of 1/16 in. The best range of feeds was from 0.010 to 0.017 ipr and a surface speed of approximately 125 fpm.

SHAPING—Uranium is readily machined on a shaper, with speeds of approximately 100 fpm and feeds of 0.020 in. per stroke. A carbide toolbit with minimum protrusion from the holder and a continuous supply of coolant are necessary.

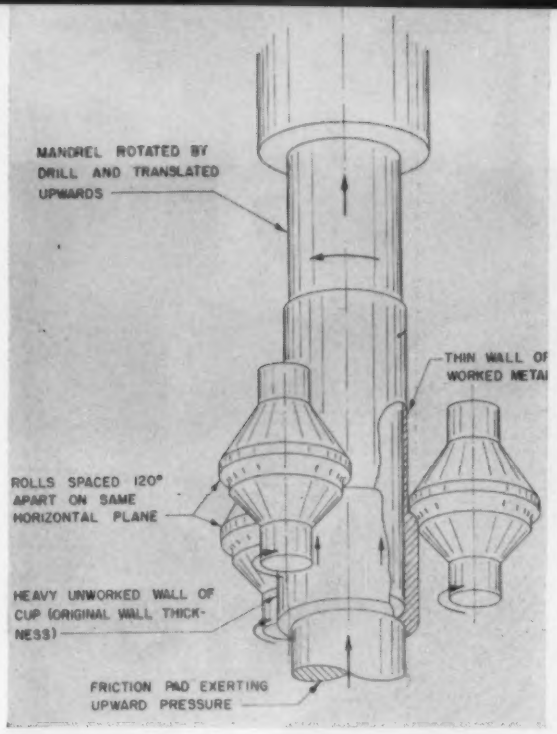


A NOVEL METHOD of supplying coolant is provided in shaping uranium. A length of flexible hose runs from coolant pump to ram, and a short length of plastic tubing connects the hose to a small tube brazed in a hole in the side of the tool holder that leads into the toolbit cavity. Coolant thus floods the cutting edge at all times

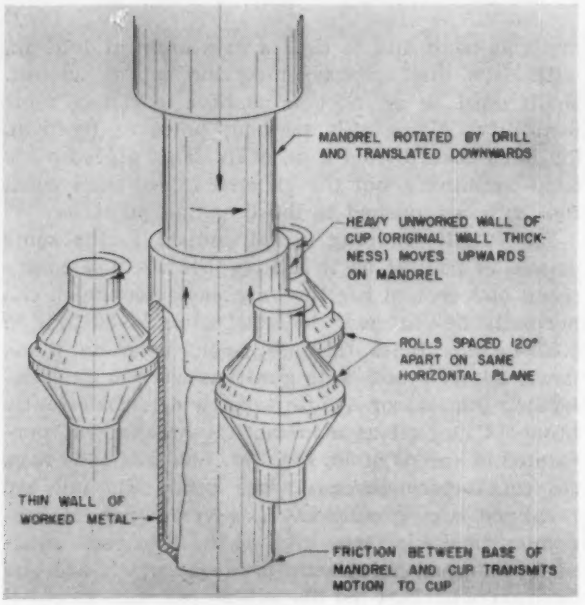
MILLING—When large amounts of stock are to be removed, milling is utilized. Facing heads of 8- to 12-in. dia with 10 or 12 carbide teeth are preferred and are used at speeds of from 180 to 240 fpm. Table feeds of around 10 ipm, with cuts up to ¼ in. deep, are used. Vertical milling with the work totally submerged in water is preferred, but horizontal milling can be employed if adequate means are used to supply coolant and quench the chips. The most practical approach found to date is to construct a chute underneath the cutter and use two or more streams of coolant to flush the chips into a drum filled with water.

PUNCH AND DIE WORK—Uranium sheet lends itself quite readily to punch work. Clean-cut holes have been obtained in 0.026-in.-thick uranium sheet in diameters ranging from ⅛ to ¾ in. No problems were encountered with standard clearance angles on the punches and dies, and although no need has risen for punching heavier stock, no difficulties are anticipated when the time does come.

The most important conclusion to be drawn from the foregoing is that whatever the operation, care must be taken that work-hardening does not occur, or if it does, that the tool cutting edges get below the affected surface for a new cut. Adherence to this rule alone will reduce the difficulties in the machining of uranium to a level well within the capacities of the average shop.


MANDREL ROTATED BY DRILL AND TRANSLATED UPWARDS
THIN WALL OF WORKED METAL
ROLLS SPACED 120° APART ON SAME HORIZONTAL PLANE
HEAVY UNWORKED WALL OF CUP (ORIGINAL WALL THICKNESS)
FRICTION PAD EXERTING UPWARD PRESSURE

Up...


MANDREL ROTATED BY DRILL AND TRANSLATED DOWNWARDS
HEAVY UNWORKED WALL OF CUP (ORIGINAL WALL THICKNESS) MOVES UPWARDS ON MANDREL
ROLLS SPACED 120° APART ON SAME HORIZONTAL PLANE
THIN WALL OF WORKED METAL
FRICTION BETWEEN BASE OF MANDREL AND CUP TRANSMITS MOTION TO CUP

...or down...

UNISKAN

A T TAYLOR,

What is it?

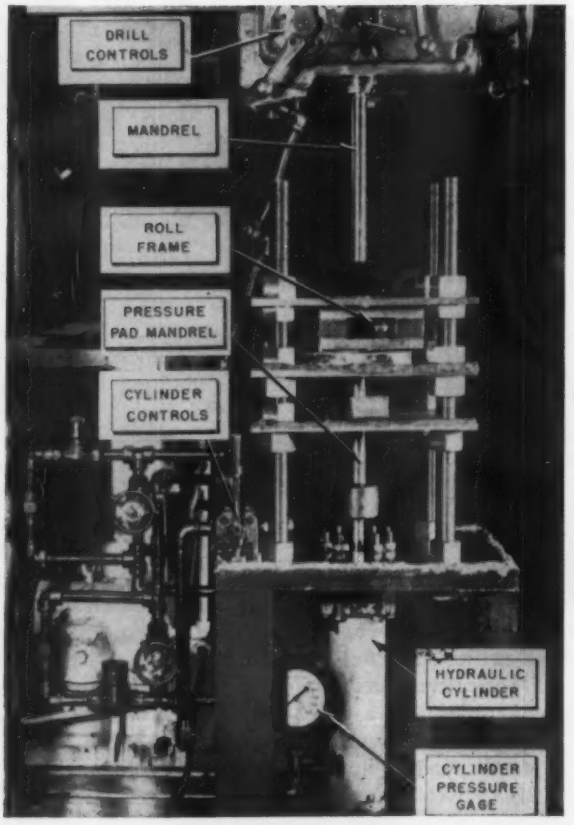
Uniskanning, an RCA-coined word from *uni* (one) and *skan* (pass), is a unique roll-reducing process for making thin-walled shells or tubing. Work is mounted on a mandrel and traversed under three rolls 120° apart in the same plane. Roll axes are parallel to the work axis. Roll pressure is high, permitting severe reductions in work thickness. For example, zirconium has been reduced 90%, and such metals as aluminum, nickel and mild steel have been reduced from heavy-walled cups or sleeves to tubes with wall thicknesses of 0.001 to 0.020 in. Uniskanning is especially useful on work with length-to-diameter ratios greater than 3 or 4 to 1, because other processes handle ratios below that

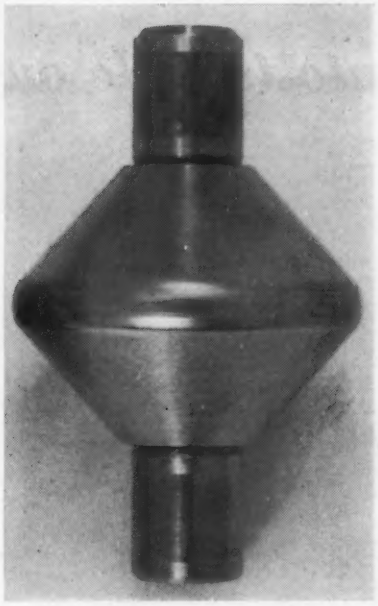
You can do it two ways...

... by driving through to the worked metal (see "up" diagram above) or through unworked metal ("down" diagram). The former is simpler, because no pressure pad is needed, but the thin shell often fails under driving torque, punching out the bottom of the cup. Driving through the unworked metal requires less upward movement of the mandrel, and avoids punching out the cup bottom. Tubular sections can be driven through the unworked metal while feeding downward, using a special mandrel. Friction, while relatively small, can be reduced still further by lubricating the mandrel.

... using a drillpress or radial ...

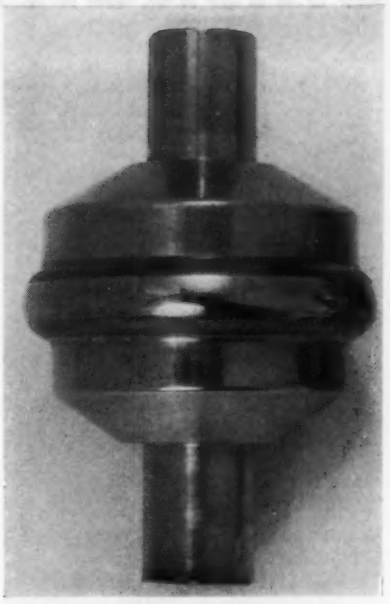
plus mandrels, rolls and roll frame, and a pressure pad, in this case a mild-steel arbor fitted with a ball-thrust bearing. Force is applied with a 2½-in. hydraulic cylinder, and pressure control is hand-throttled. Good surface finishes were found for 1½-in. OD shells with maximum speeds of 400 rpm, 0.006-in. spindle advance per revolution





...and rolls...

. . . made of high-carbon, high-chrome steel hardened to 60-63 R_c. Two general roll designs worked well: (1) a double-cone-shaped one for light reductions on hard, less-ductile, thin-walled material such as drawn zirconium shells, and (2) a roll with a vertical shoulder that prevents the work from bulging under pressure and forming a lip. This design can be used on hard or soft material for large reductions. Its disadvantage is that each such roll is designed for only one amount of wall-thickness reduction—equal to the distance from shoulder to rim or roll. Less reduction does not take full advantage of the design

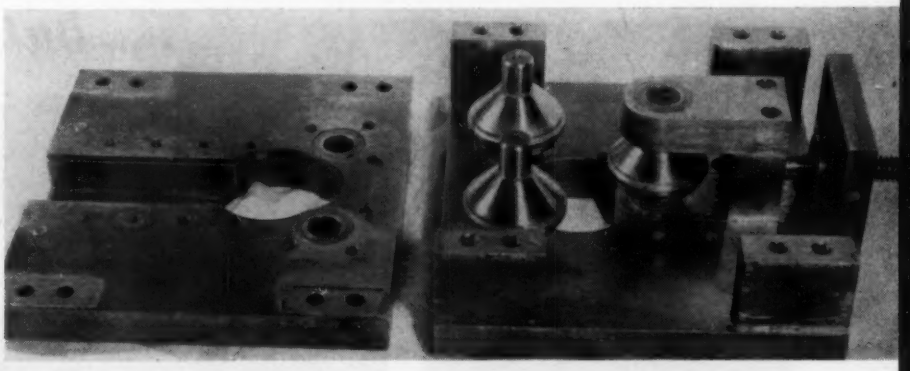


roll-reduces in one pass

HANFORD ATOMIC PRODUCTS OPERATION, GENERAL ELECTRIC CO, Richland, Wash

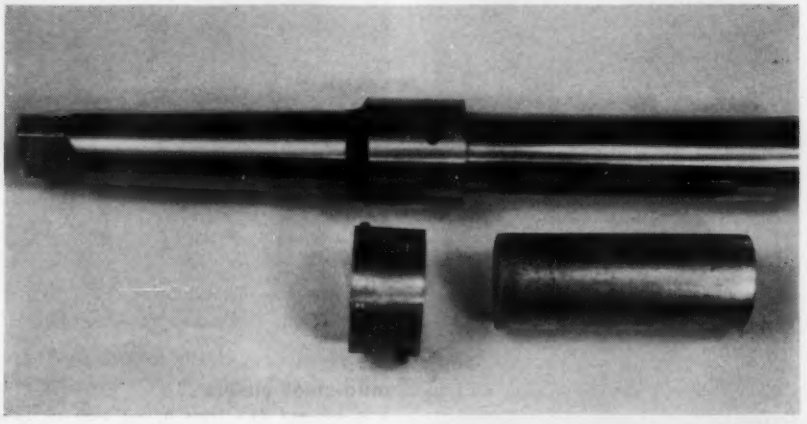
...frames...

Several roll-frame designs can be used in uniskanning, ranging from this open cage shown at right to an almost totally enclosed, extremely rigid design. First frames had precision needle bearings and ball-thrust bearings for support and alignment, but bronze sleeve bearings were used in later models, acting simultaneously as thrust and sleeve bearings. Roll movement in radial direction is limited to one roll, with location adjusted by a threaded shaft



...and mandrels...

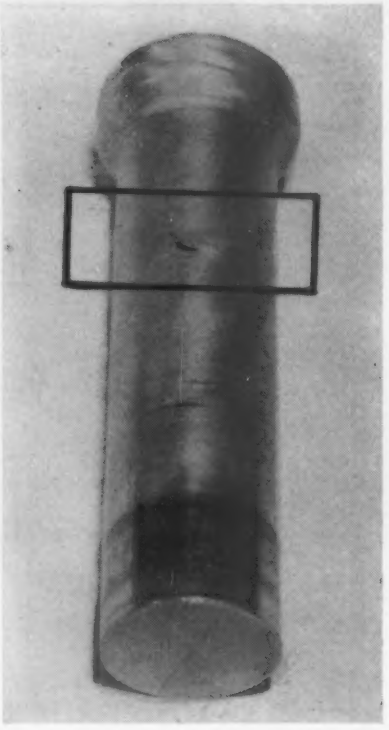
Mandrels for uniskanning sleeves are, like the rolls, made of 60-63 R_c high-carbon, high-chrome steel. Shoulder and collar keep work from climbing up mandrel. Work is traversed downward past rolls. Most of uniskanning's driving force comes from the pressure-pad mandrel and driving mandrel. If the mandrel slips in the cup, the pad is pushed harder against the cup base. Pressures to 1250 psi have been needed when making large reductions in heavy-walled aluminum



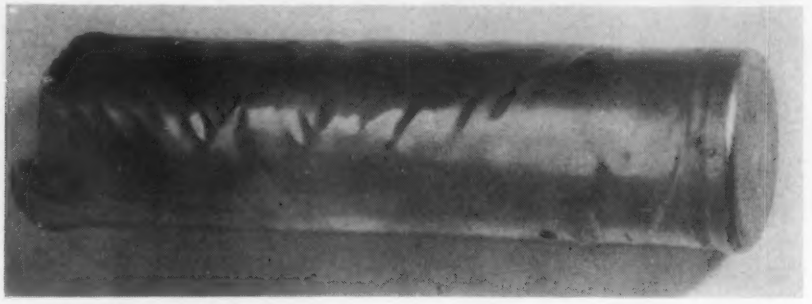
...and here's what you can and can't do with uniskanning ▶

uniskan . . . CONTINUED

. . . runs into trouble on

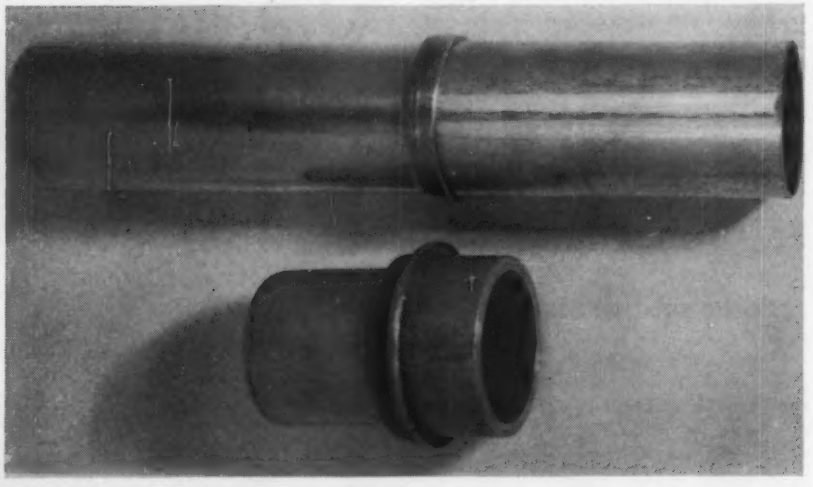


diagonal failure . . .
resulted when aluminum alloy (6-8% Al_2O_3) was 70% uniskan-reduced from a machined cup. With initial roll design, it was difficult to make large reductions in annealed aluminum in one pass



a nickel sleeve wrinkled . . .
. . . because of torque failure while driving through the thin wall. Available equipment at GE's Hanford operation made it hard to make a large reduction in one pass without tensile failure of the thin wall

. . . but it works pretty

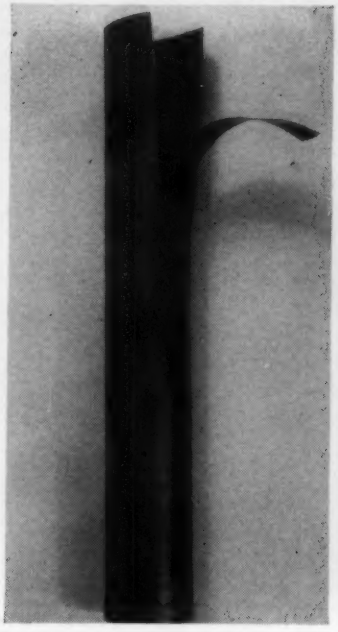


aluminum cups . . .
that were uniskan-reduced in wall thickness 60% for both cans. Notice how lip is turned up by the rolls

mild-steel sleeve . . .
was reduced 72% from 65-mil wall to 18-mil wall. Surface defects were caused by impurities in the stock

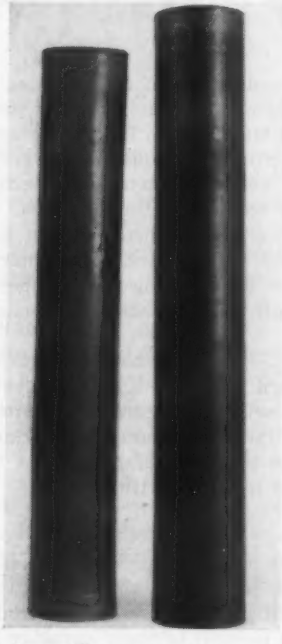
knotty problems like these

bottom-tensile failure . . .
resulted in attempting to uniskan a ⅛-in.-wall zirconium cup. Other failures generally resulted from cracking of brittle materials—similar to season-cracking in brass—and diagonal failures



a strip split out . . .
of this 0.005 in. zirconium shell, indicati unbalanced residual stress pattern

well on jobs like these



zirconium alloy cans . . .
were uniskanned from as-drawn shells. At left is 3-mil can made from 35-mil-wall shell. Other, 5-mil-wall can was rolled from 21-mil shell

cans from drawn shells . . .
aluminum workpiece (left) was partially uniskanned from 35 mils to 2.5 mils. Wrinkles resulted from handling the fragile shell. Piece at right was progressively uniskanned from 65% reduction to 90% reduction from 65-mil wall

Uniskan worked all right here . . .
but collapse resulted from air pressure on part as it was withdrawn from mandrel. The 35-mil aluminum can was reduced to 8-mil wall thickness

TWO APPLICATIONS OF NUMERICAL CONTROL . . . NO. 1: punched cards. Epitomizing current tremendous

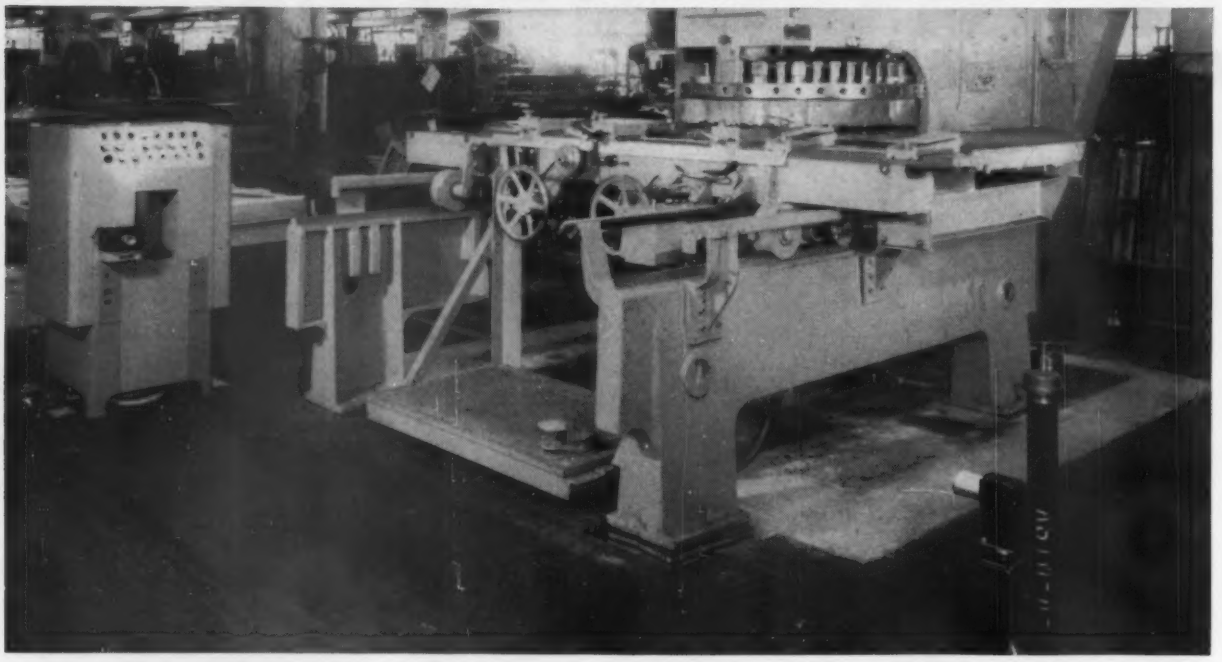


FIG 1 .. Numerical control operates this Wiedemann turret punch press. Punched cards, stacked in the director at left (one card for each hole to be punched) provide control. Here the safety fence has been removed for the picture, but the light source (lower right) and the photo-cell safety control (on the face of director at far left) can be seen

Turret punch, and sheet location controlled

Numerical control can range from simple on-off instruction systems to complex units capable of computing continuous curved paths. Here is an excellent example of the less-complex, hence less-expensive, system that has wide application. Workpiece is positioned, tools selected and set, and punching done in a fraction of the time required for manual operation—all by instructions read by the control from punched tabulating cards. This basic control is also being applied to other machine tools, such as automatic lathes and drills

LEROY U C KELLING
Engrg Section, Specialty Control Dept
GENERAL ELECTRIC COMPANY, WAYNESBORO, VA

All departments of General Electric are working to develop new techniques of manufacturing better products at lower cost. At the March, 1954, IRE Conference, B Warriner of the Electronics Laboratory described and presented films of an experimental numerical-control system for a Wiedemann turret press, developed in the laboratories. This control system used an electronic counter and a photoelectric scanner to measure length of motion by counting the number of ruled lines on a glass scale, which passed the scanner during motion.

The Specialty Control Department has subsequently developed a punched-card numerical control system which uses multi-speed selsyns for measurements of position. Although this latter equipment was developed for sale to machine-tool builders, the pilot was installed on a production machine within GE.

FLEXIBLE PROGRAMMING

Modern, high-production, machine tools such as lathes, drilling machines, boring machines, and grinding machines are frequently used in short-run production where only a small portion of their capacity can be realized. Great increases in the productivity of such machines can be obtained by an automatic programming control which is flexible and economical. Numerical control will give many of these machines automatic operation equivalent to that of an automatic screw

development before the Chicago Show. See also *AM*—Oct 25 '54, p 133 . . . a Special Report

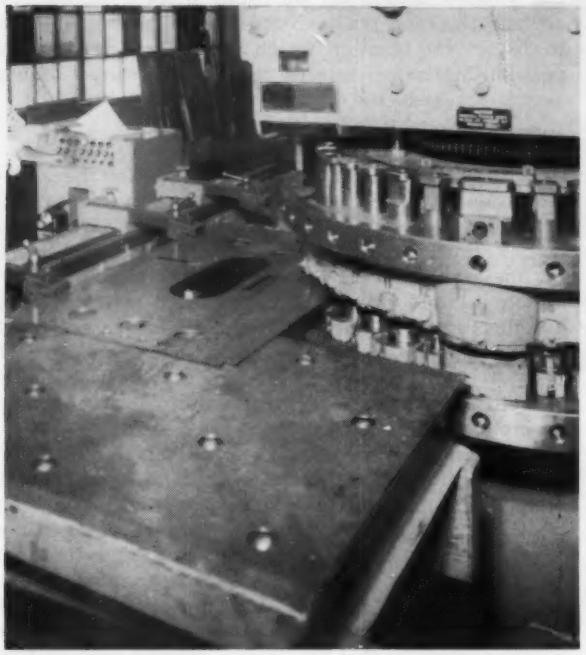


FIG 2 . . Here is a closeup of the turret, workpiece and auxiliary table. Holes of various shapes and sizes can be punched in metal sheets, for low and medium production runs, by rotating the mating punch and die turrets to bring the desired set into punching position, where they are accurately aligned by tapered locking pins entering the peripheral holes. (The work holding device here shown has since been changed.)

FIG 3 . . A card-reading-machine base, common to several Remington Rand tabulating machines, is converted to a director by adding a pushbutton control station and the director selsyn positioning mechanism. The card reader feeds cards from a hopper into the card-reading pinbox, then out to the stacker. The card retained in the pinbox at the end of each card-feed cycle is probed by mechanical pins which push up through any holes, are locked, then push 0.2 in. further with 2-lb force. This stroke can be used to operate switches or to transfer mechanical motion to other locations through Bowden pushwires. In one card-feeding cycle, the card reader reads one card at a time, stopping in a position that retains the reading

by punched cards

machine without the high expense of making, setting-up, and storing cams and special templets.

Numerical control of machine tools can be defined as machine-tool control which is exercised in accordance with numerical instructions. Such numerical instructions can be given in binary, decimal or other digital forms on many media such as punched tapes, punched cards, and magnetic tapes.

ADVANTAGES

Numerical control has nine distinct advantages:

1. Faster, more accurate, and has fewer random errors than manual control.
2. Instructions can be economically and readily prepared, altered, reproduced, and stored.
3. Provides a flexible automatic machine operation with minimum setup time between jobs.
4. Provides for automatic machine cycles of complexity far greater than is possible by other means.
5. Eliminates drawings of many machine parts, yet stores the dimensions of these parts in the form of working numerical instructions to machine tools.
6. Reduces the work of preparation of machine instructions to a minimum of time and expense.
7. Greatly increases machine productivity and reduces manufacturing costs.
8. Extends the field within which a given machine can be economically used.
9. Instructions are capable of being used in identical machine tools in other plants in other cities. This method should make it possible to mail machine instructions instead of spare parts.

CLASSIFICATIONS

Numerical-control instructions to machine tools are essentially either instructions to select various mechanical operations, or instructions to position certain machine parts to specified locations. Selection instructions are essentially on-off functions. Positioning instructions have many degrees of refinement and may be divided into these five classifications:

Type 1. Point-to-point positioning without regard to path or velocity.

Type 2. Point-to-point motion along one axial direction and at a specified velocity.

Type 3. Point-to-point motion along an approximate path loosely specified by controlling the velocities of each motion.

Type 4. Motion along a succession of straight-line paths between successively specified points and at a specified velocity.

Type 5. Motion along a smooth, curved path passing through several successively specified points and at a specified velocity.

The numerical-control system applied to the Wiedemann turret punch press is essentially the Type 1 po-

sitioning system. This can be readily modified by adding speed control to produce either the Type 2 or the Type 3. The Types 4 and 5 systems, which require a computer to compute the tool path, are considerably more complex. However, the Type 4 and 5 systems may use the same data reader and motor controls as the simpler systems.

This punched-card, numerical control system, Fig 1, permits the punch press to be operated by either manual or numerical control. The workpiece is positioned with respect to the punching position by means of the X and Y axis carriages. For manual operation, the machine operator cranks the X and Y handwheels on the front center of the machine to bring the workpiece into proper position as indicated on ruled scales on the respective carriages. Rotating turrets contain 32 punch and die sets, and are positioned by a reversing motor control which the operator can either jog or run at full speed.

MODIFICATIONS

In applying numerical control to this machine, a dc motor was connected through gearing to rotate the turret. Similarly, two other motors were connected to the X and Y work-positioning mchanisms. The dc motors were powered by electronic, reversing, motor controls actuated by the numerical-control system.

Position-indicating units containing multi-speed selsyn generators were attached to each of the turret-drive mechanisms and the X and Y work-positioning mechanism to obtain an exact indication of their positions. Hand control of the X and Y work positions necessitate unmeshing the gear between the motor and the work-positioning carriage. In manual control of turret position, the turret-motor control is switched from selsyn signals to a reversing, run-job switch.

Associated with each column of numerical-position data which retains the reading card is a numerical digit-reading assembly. This digit-reading assembly stops a rotary motion in one of ten equally and accurately spaced stop positions as a function of the decimal number punched in the respective column of the card. Mechanical movements of these digit-reading assemblies, associated with a given multi-digit number, are mechanically combined to position simultaneously the rotors of each selsyn control transformer. Angular position of each rotor is exactly the same as the rotor would have if all were geared together by successive 10:1 gearing and they were rotated to a total decimal angular position equivalent to that specified by the numerical information in the card. Thus, although the director selsyns do not rotate more than one revolution, the card reader rotates the director selsyns to the exact combination which will be required of the position-indicating selsyns when the desired dimension is reached.

POSITION INDICATION

The position-indicating units of Fig 3, for the X and Y motions, each contains four selsyns geared to each other by successive gear ratios of 10:1. Thus, first, second, third and fourth, the selsyns rotate respectively, one revolution per 1 in., 10 in., 100 in., and 1000 in. of longitudinal travel. In the position-indicating unit for the turret, the first and second selsyns rotate respectively, one and ten revolutions of the selsyn per revolution of the turret. Decimal gearing was chosen in both cases to coincide with a decimal arrangement of input information.

This combination of multi-speed selsyn generators in the position-indicating units and multi-speed control transformers in the director is essentially that conventionally used in military fire-control systems. However, in this numerical-control system, Fig 4, the number of the selsyn speeds used is lower than those used for military fire control. In connection with these multi-speed systems, it is necessary to use take-over circuits to insure that the various selsyns varying from coarse to fine take over control in proper succession, to bring final correspondence at which the selsyns in the position-indicating units are in exact alignment with the corresponding selsyns in the position director.

The output signal from the take-over circuit is amplified and applied to a discriminator circuit, which compares the polarity and magnitude of the signal to that of the exciting voltage applied to the selsyn generators, to produce a dc output voltage, indicative of the magnitude and direction of error in position. The output voltage of the discriminator is proportional to the error in position for small deviations, essentially constant for large deviations. The output signal of this discriminator circuit is applied to electronic, reversing motor control to cause the drive motor to operate to bring the system into the desired position of correspondence. An error-monitoring circuit is incorporated to detect the condition at which the error in correspondence becomes and remains very small for a short time.

MOTOR CONTROL

This installation uses 1/3- and ½-hp, dc shunt motors powered from ½-wave Thyratron tubes reversely

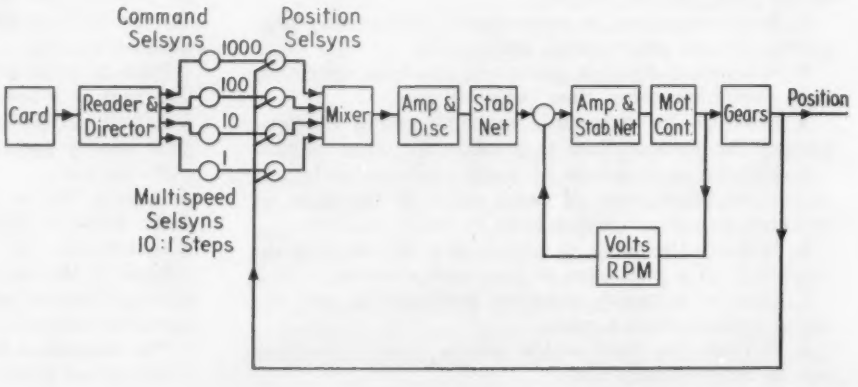


FIG. 4 . . A multi-speed selsyn position-indicating system coupled with a servo-mechanism to position machine elements makes up the numerical-control system. Selsyn (or synchro) generators of the machine position-indicating units make up the followup. Selsyn control transformers of the card reader direct the machine elements. Signals of corresponding connected-pairs selsyns are compared by the electrical circuits, which then operate the drive motor to bring each selsyn generator of the director to the angular position corresponding to instructed position

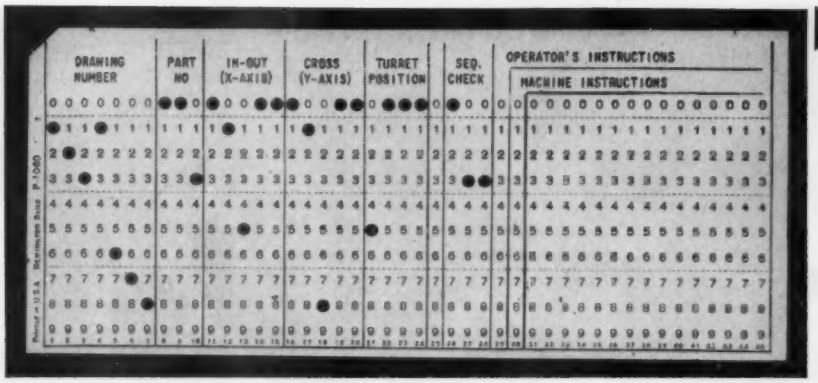


FIG 5 . . Remington-Rand 45-column tabulating cards, punched as this one is, control the operation. (90-column cards are also available, but not needed here.) Cards are punched in standard R-R machines from a tabulation of dimensions. (Designers or planners could punch their own cards, too.) Cards may be ordered with pilot holes prepunched in each potential hole position to locate the larger holes punched by hand. Thus machine operators can replace damaged cards, or make a card or two with different instructions. Cards can also be duplicated in standard office reproducing machines. Cards will last, with reasonable care, for several hundred feedings through the card reader

connected with respect to the armature. Where higher horsepower and improved performance are required, electronically controlled amplidyne generators are used. The motor control used for driving the positioning motor can be of many forms depending upon horsepower requirements and the speed of response of the system.

The Remington-Rand 45-column tabulating card, Fig 5, contains identification information such as a drawing number and part number in addition to the instructions for the machine. In-out and cross-feed dimensions are specified as a five-digit decimal number, giving dimensions to the nearest 0.010 inch. Turret position is specified as a four-digit decimal number, capable of specifying the turret position to 1/10,000 part of a revolution. Positioning instructions to the machine are given in the decimal, digital form; selection instructions are given in the form of decimal codes in the machine instruction column. The column of operator's instructions is provided to give the operator coded instructions when required. Three columns of the card are used with a sequence-checking circuit which prevents control operation from instructions on cards out of sequence. One card is required for each machine operation, and a whole deck of cards must be read once for each complete part.

CHECKING CONTROLS

Punched into each card is a three-digit sequence number. The control system contains a sequence counter which advances one count for each card unless instructed not to do so by a special code on the card. The sequence number on the card must check with the sequence number in the counter before the machine can operate on the instructions contained in that card. When the machine stops, because of a card out of sequence, an indicating pilot light is illuminated. It is possible to insert additional cards of the same sequence number within the deck in their proper location by using an additional code which prevents the sequence counter from advancing.

Where there are several parts identical in most respects but different in a few, one deck of cards can be used for all by adding a group selection control which operates on the part number columns. This group number control will accept all cards with common instructions, plus others for a specified part number. All cards not contained in these classifications will pass through the machine at the maximum card-reading rate.

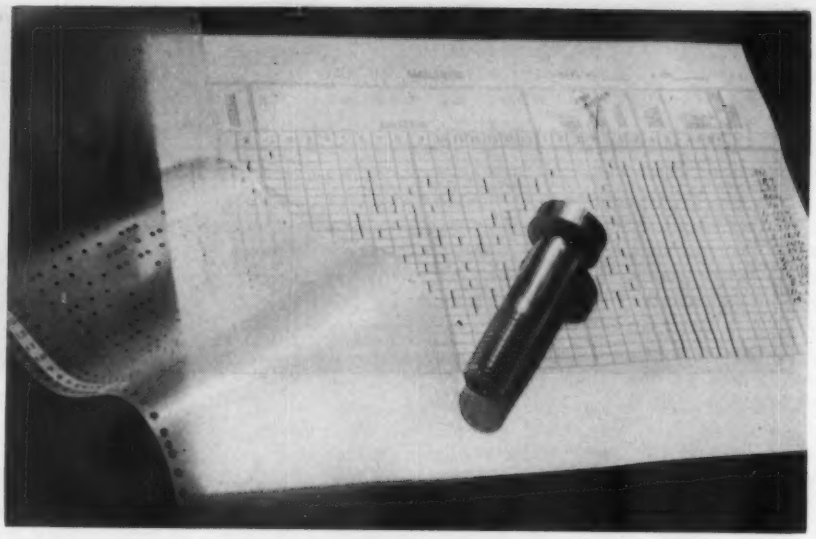
MACHINE CONTROL INSTRUCTIONS

A great deal of flexibility and a large amount of interlocking must inherently be included in an automatic control system for machines of this type. There is a column of numbers in the card for machine instructions which can be punched to achieve either positioning and punching, positioning without punching, neither positioning nor punching, or positioning and center punching. The turret of the punch press contains an air-operated center punch mounted in one of the regular punch and die positions. This center punch is used for indicating the location for other machine operations which cannot be performed within this press.

For die punching or center punching, the same decimal location of the turret is used with different machine instruction code numbers. The machine instruction, which calls for positioning without punching, is normally used for detouring around one of the work clamps which is interposed between two holes which must be punched in line. The same positioning-without-punching code moves the work to a location which is convenient to the operator for shifting work clamps or rotating the workpiece. For this latter operation, the card would contain a code instructing the machine to stop the automatic cycle after positioning in addition to an operator's instruction code indicating the reason for the stop.

RESULTS WITH NUMERICAL CONTROL

Numerical control has shown several advantages over manual operation. The numerical control system is capable of simultaneously positioning all three motions at high speeds, while the manual operation is capable of positioning but one at a time. Thus, the operating time required for a given piece has been reduced to one-third or less. Operating times for a complete positioning and punching operation vary from approximately two to eight seconds per punched hole, depending upon the magnitude of distance moved. With automatic operation, the accuracy of positioning is uniform on all operations, and there are no random errors such as frequently occur with manual operation. The operator's time is not lost during automatic operation of the machine, because he can perform many of his other functions, such as handling materials and filling out work tickets. The net result of automatic operation has been a great increase in productivity as well as a great reduction in the cost of manufacturing. This equipment quickly pays for itself.



PROGRAM, PLASTIC TAPE, AND PART— operation of numerically controlled turret lathe is almost that simple. Program is prepared from part drawing, with help of code book, and tape is punched as indicated. Tape is placed in reader and machine is set up with preset tools. When barstock is placed in machine, simply pressing a button starts production. Bolt shown is produced at 3000 rpm, including threading, using carbide tools. Surface finish is 2 mu-in. rms

Simultaneous and sequential control:

Tape gives turret lathe short-run

Why put numerical control on a turret lathe? First, because a turret lathe is a highly complex, multi-operation machine requiring skillful operation and constant attention. Numerical control minimizes both the skill requirement and the need for constant operator attention. Previous automatic turret lathes, using mechanical or electrical controls, are too costly to set up for short runs. Tape gives more versatility, is easily made, and can be stored for future use. Numerical control opens a wide field of turret-lathe applications not previously considered practical

JOHN R NICHOLS, development engineer, JONES & LAMSON MACHINE CO, SPRINGFIELD, VT

Developed especially to fill the need for a more versatile automatic turret lathe, the Jones and Lamson No. 7A-2½ NC machine was designed and built for numerical control by punched tape. While the present machine is experimental, with approximately the same dimensional and power capacity as our standard No. 7A saddle-equipped turret lathe, the standard feed and fast-motion drives have been replaced with drives especially designed for the numerical control system.

In addition, we have used a new headstock design which provides 16 speeds, hydraulically shifted with friction clutches, plus our newest design of saddle with geneva-motion turret-indexing mechanism, as all of these improvements are readily adaptable to numerical control.

We expect that the versatility made possible by numerical control will open new fields of *application* for the turret lathe where production demand heretofore was impractically small. Even the conventional production applications will be benefitted by the simplified operation and setup.

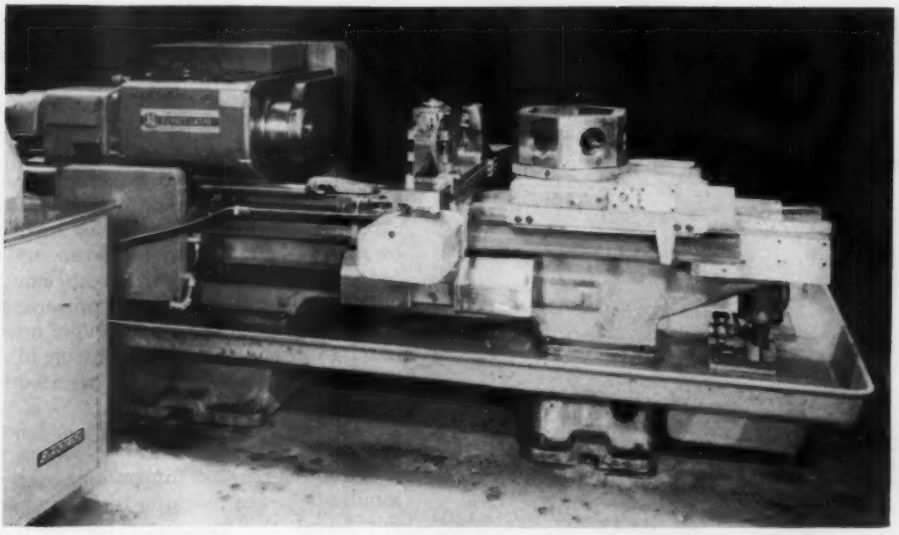
Completely controlled from punched tape, the machine is automatically cycled and provides rectilinear motions with precise control at the end points. It does *not* produce contours in the manner of the MIT milling machine, developed by their Servo-Mechanisms Laboratory, by simultaneously coordinating two or more motions. Instead, the tape delivers commands to the three motions in the form of end-point positions and speeds. In addition to these commands, the tape controls:

1.) Choice of 16 spindle speeds, at any time and without stopping the spindle.
2.) Indexing six-position turret to any face at any time.
3.) Indexing four-position turret on cross-slide to any face at any time.
4.) Operation of hydraulic-powered collet chuck and bar feed.
5.) Coolant (on or off).
6.) Hood (close or open).
7.) Resetting of tape to repeat cycle.

The 32-speed geared headstock has two ranges of 16 speeds, forward and reverse, all from a constant-speed drive motor. The high or low speed range is manually selected, according to the work diameter, and then any one of the 16 speeds can be automatically selected by the tape control. Solenoid operated hydraulic valves control clutch operation to effect speed changes without stopping the machine.

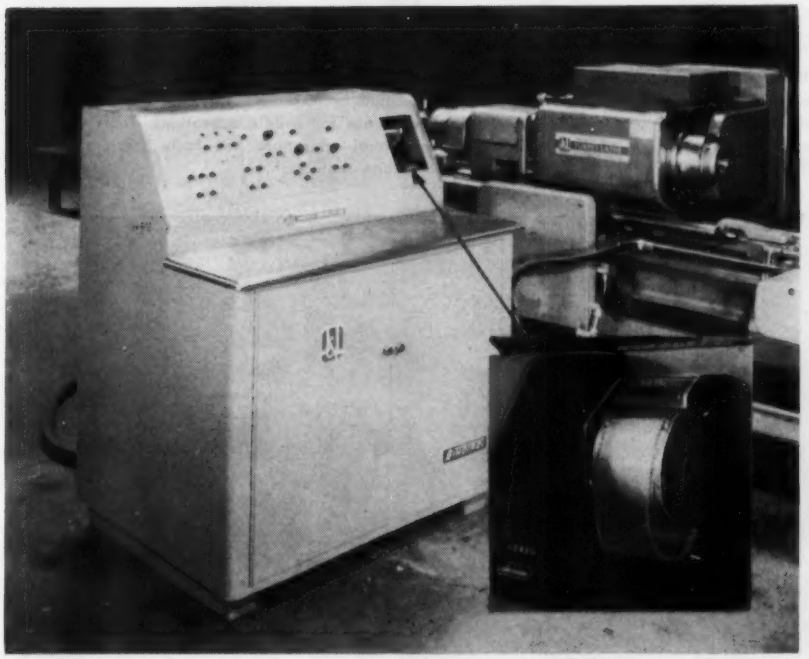
An independent motor indexes the six-position turret at any position along the bed, through the geneva motion. For each operation, the desired turret face is coded and punched into the tape. Thus any face can be brought into position at any time. Once started, the geneva driver continues to turn the turret

tremendous development before the Chicago Show. See also *AM*—Oct 25 '54, p133, a Special Report



LOOK—NO HANDWHEELS! Completely automatic control eliminates the need for handwheels *and* the operator fatigue they represent. Actually, the machine can be automatically controlled by the tape; manually controlled, for setup and checking, by pushbuttons and switches on the panel; or by a handcrank inserted into any of the gearboxes for emergency operation. Hood controls are provided but hood was not installed on experimental machine to be used for demonstrations

flexibility



BINOTROL is located adjacent to the turret lathe; contains the control elements including tape reader, telephone-style relays, and the control panel. Tape reader (insert) is at right of control panel and tape is placed in reader, usually with end joined to form a loop. Counter shows number of cycles completed, hence number of parts produced. Control components are commercially available to simplify maintenance and minimize downtime

until the called-for face comes into position.

Thus, all machine functions are determined by the punched tape, which uses binary-number coding for maximum utilization of tape space. Tools have been developed which are preset to gages for a given dimension. Therefore, as soon as it has been determined that a part should be turret lathe produced, this system makes it possible to obtain a drawing, code the necessary information, punch a tape, set the tools, and make a part without further tool adjustment. The tape is readily modified to change the sequence or dimensions in any cycle.

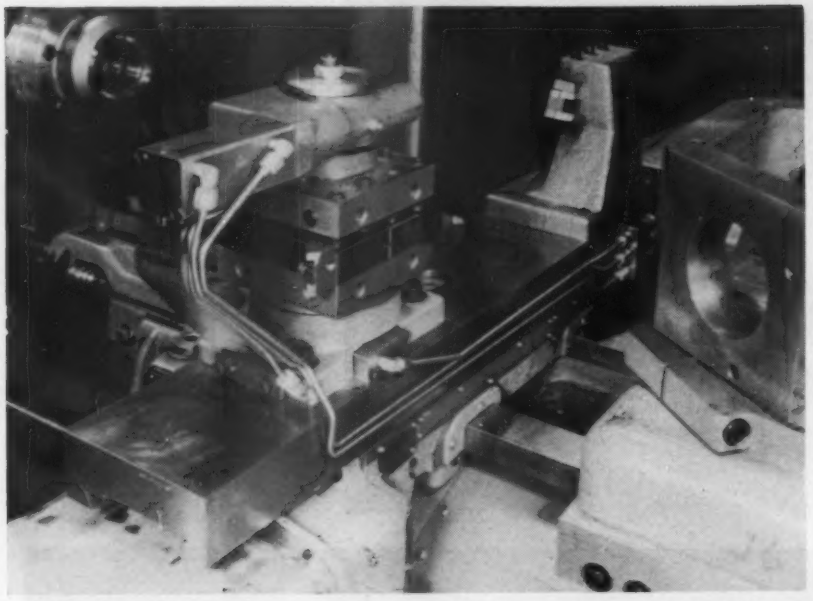
WHAT NC ACCOMPLISHES

Conventional turret-lathe operation requires a fair degree of skill plus manual dexterity and stamina. In addition to knowing the correct sequence of operational elements, making tool adjustments, and checking finished pieces, the operator must exert a constant physical effort. Because of the highly repetitive nature of the job, the operator is subject to continual mental and physical strain, which is conducive to fatigue and error.

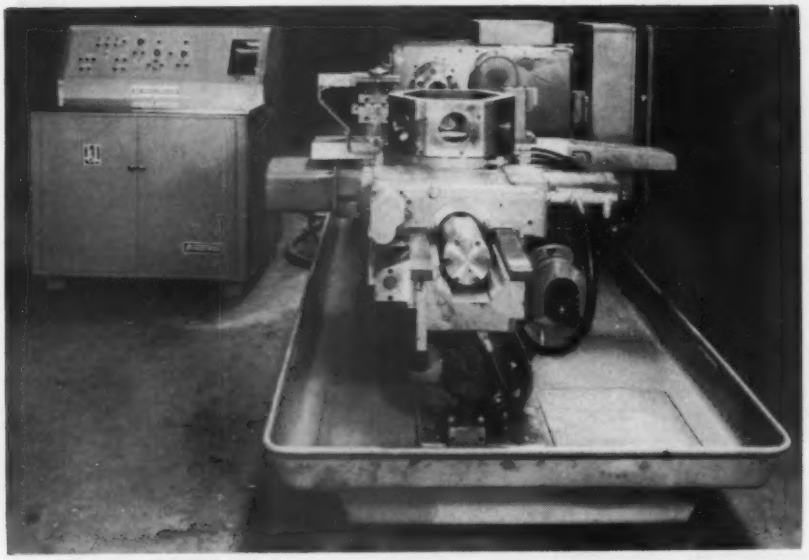
Operator accuracy on repetitive operations is limited. A human operator can only repeat so many times without an error and the intricacy of sequencing, frequently indicating a complicated and expensive job, is directly related to the frequency of error. For example, a bottle mold having thin, closely spaced, cooling fins might be needed in quantities too small to warrant the expense of making a gang grooving tool. On the other hand, it is difficult for a man to make all of the grooves without error using a single-point tool. A special setup on an automatic would not be economical for the quantity of pieces involved. However, until now, one of these less-than-ideal methods would have to be employed. And the cost of the job would be high.

Numerical control makes this kind of problem simple. Programming the tape for closely spaced fins is no more difficult than tape preparation for any other job and would be practical for even one piece.

Modern turret lathes operate at high speeds. Flying coolant, chips, etc, require the use of a hood. On conventional machines, a hood is seldom used with full benefit because



FOUR-POSITION TURRET on cross-slide is indexed to any face at any time by hole pattern punched into tape. Cross-slide travel is programmed in increments of 0.0005 in. Tape will also park carriage and cross slide under spindle nose for saddle operations. Tools may be mounted on the rear of the carriage for additional operations. All tools are preset and only sampling inspection is needed to maintain consistent quality



SIX-POSITION SADDLE TURRET is indexed through geneva motion by an independent motor. Turret rotates until signal from tape causes it to stop at desired face. Feed motor is thyratron controlled and provides 16 rates. However, actual feed-power is hydraulic. Motor simply controls hydraulic valve. Saddle is programmed to any end-point position over 30-in. distance within 0.001 in. by binary number coding

the operator must get his hands into the work area. Hence conditions are dangerous, messy, and annoying; tend to reduce output. Using numerical control the controls are off the machine in a separate cabinet and the hood is controlled by the tape to suit cycle and tool action. Except for loading and unloading, or setup, there is no need for the operator to put his hands into the work area.

Setup, heretofore, required a skilled operator or a setup man. Now the setup is planned by a methods engineer or "programmer" and the tape is punched accordingly by a clerk, both in the office. The tape is delivered to the machine with the shop order and operation sheet or tool scheme. An unskilled operator can mount the numbered, "plug-in," preset tools according to the chart and can place the tape in the machine director. As simply as this, the machine is ready to produce pieces. Upon completion of the run, the tape can be stored in a filing-cabinet drawer for future uses such as new orders, to replace scrap, or for spare parts. Standard tapes can be prepared for routine operations, frequently repeated, and kept on hand to expedite simple jobs or to simplify preparation of complicated setups.

WHAT MAKES IT WORK?

Three sources of information are available to the machine in its present form: For automatic operation there is the punched tape. For manual operation of the machine there is a panel of pushbuttons and switches which can be used to jog the motions and to select any of the available feeds and speeds. Finally, for emergency operation there is a handcrank which can be inserted into any of the gear boxes to move the tools.

An individual hydraulic servo system, controlled by a precision leadscrew, powers each of the three tool motions—carriage, cross slide, and saddle. The leadscrew is turned either at high speed by a 1/10-hp fast-motion motor or at slower speeds by a 1/25-hp normal feed motor. These two motors drive each leadscrew through an epicyclic differential transmission. All of this equipment operates at very low power because the leadscrew does not drive the toolslide directly, but simply controls the hydraulic servomechanism. Thus the only load on the screw is in stroking the servo valve and wear is held to a minimum.

The 1/25-hp feed motor is variable speed, thyratron controlled. It provides a choice of 16 feed rates, which are selected either by the tape or by switches at the control panel. This thyratron control constitutes *the only electronics in the entire machine control.* The rest of the system is comprised of commercially available telephone-style relays.

Geared directly to each leadscrew is a device called "Binotrol" which, in effect, divides the total angle turned by the leadscrew (which might be considerably more than 360° as it is 360 times the number of revolutions of the leadscrew) for the full stroke of the toolslide into approximately 30,000 parts. In other

words, for each thousandth of an inch along the ways Binotrol produces a unique electrical signal. This is the "feedback." It gives the actual position of the toolslide.

This signal is compared to a similar signal from the punched-tape reader which represents the desired position of the toolslide. The set of relays comprising the comparison circuit interprets the result and gives commands to the motors, telling them in which direction to go and anticipating the end point by a certain distance, depending upon the speed of travel, so as to reach the actual end point at a creep rate that will prevent overshooting and damaging work or tools.

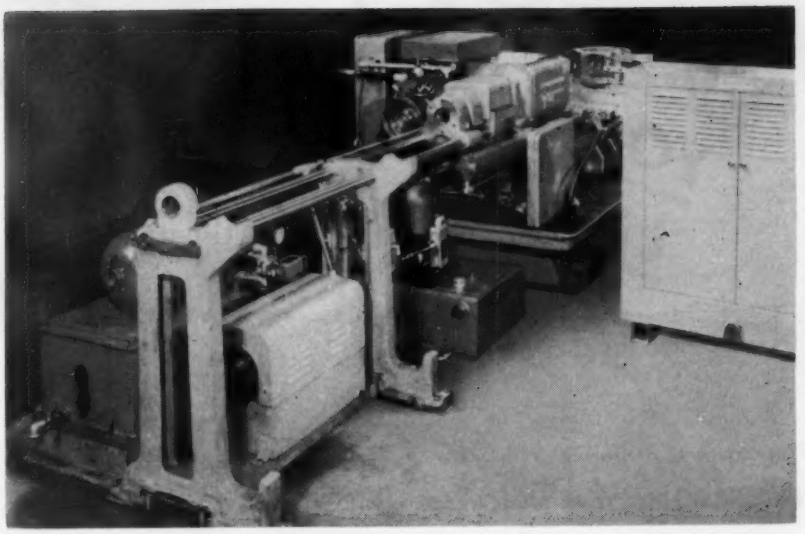
As described, the 5-in.-wide plastic tape performs many functions. A single space across the tape can contain a maximum of 32 holes, although an information pattern almost never calls for all 32. The tape reader detects the presence or absence of each of the holes in an entire row simultaneously, in the manner of a punched-card business machine, by making electrical contact through the holes.

Each row of holes is one command to one motion to travel to a certain location at a certain feed rate with a certain spindle speed. Each change of speed or position requires a separate row of holes and about 1-in. of tape (length) is required for each cutting operation performed by the lathe. The ends of the tape are usually fastened together to form a loop so that the machine can be recycled without reversing the direction of tape travel.

Hole allotment for each function:

FUNCTION	DIGITS
Address — carriage, cross slide, saddle, miscellaneous	2
Linear position — 32 in. by 0.001-in. units	15
Feed rate — choice of 16 feeds plus fast motion	5
Dwell time (at end of stroke) — 0, ½ sec, 1 sec, 1½ sec	2
Tape index — carriage, cross slide, saddle, miscellaneous	2
Spindle speed — 16 speeds fwd, 15 speeds rev, stop	5
Spare — to control auxiliary equipment, etc	1
Total	32

Binary-number coding makes it possible to measure 32.767 in. in increments of 0.001 in. using only 15 digits, thus: Each hole position, across the tape, starting with one, is double its predecessor as, 1, 2, 4, 8, 16, 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, and 16,384. By selecting a series of holes, or "digits," any number from 0.001 to 32.767 is obtained much in the same manner as adding gage blocks. This system is used for measurement.

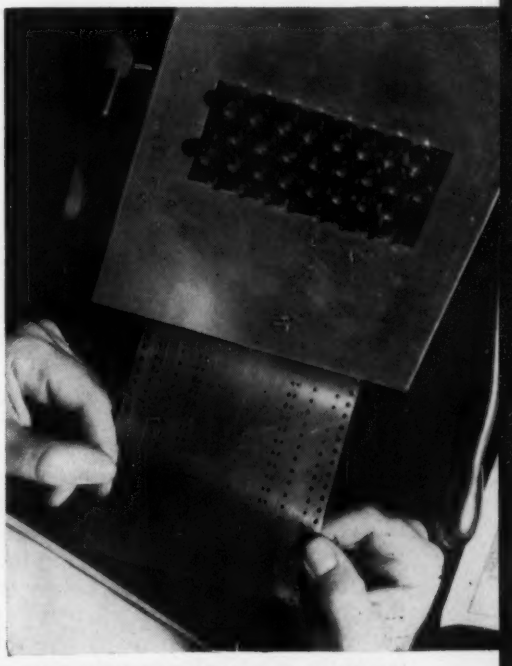


BAR FEED AND COLLET CHUCK are hydraulically actuated; are also sequenced by the tape. Headstock provides high and low range of 16 speeds, forward and reverse, all from a constant speed drive motor. Range is manually selected, then choice of 16 speeds within each range is tape controlled. Hydraulically shifted friction clutches change speed without stopping spindle; are actuated by solenoid valves

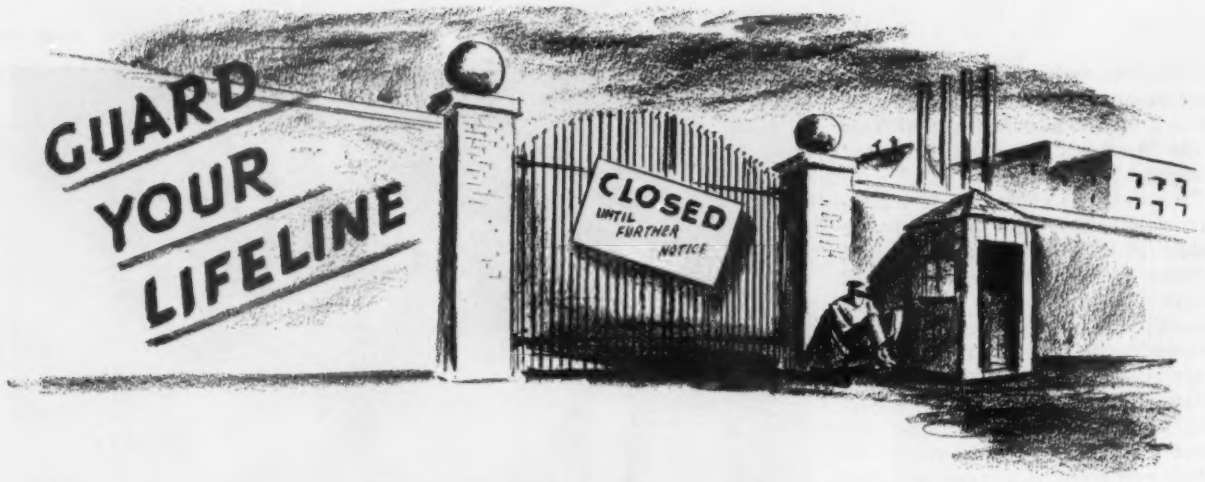
For selecting a function, the same kind of hole in a different location on the tape is used in a variation of the binary code. Two digits permit four possible functions: no holes, first hole punched and second hole blank, first hole blank and second hole punched, and both holes punched. As each of these combinations appears on the tape it selects a specific function such as zero dwell, ½-sec dwell, 1-sec dwell, or 1½-sec dwell. Three holes permit eight possibilities. Five holes give the user a choice of 32 functions. For example, feed-rate instructions on the tape use four holes to provide a range of 16 feeds and a single hole to indicate whether or not fast motion is required.

To determine how many holes are required to provide a unique pattern for each of a given number of functions, it is only necessary to raise 2 to whichever power provides the number of unique patterns desired. The exponent is equal to the number of holes you will need. Thus, 2^5 equals 32 hence 5 holes provide 32 unique patterns or will control 32 functions. Why the number two? Because for each hole location, two possibilities exist. Either you punch a hole or you don't punch it.

Flexibility is apparent. Any order of instructions punched into the tape will be executed by the machine in the same order. There is no need to set up cams or stops, only plug-in tools and the tape. Motions can be started simultaneously or in sequence so that the optimum cycle pattern for a particular job can be programmed. The control system, including Binotrol, was developed by The Barnes Engineering Co, Stamford, Conn.



TAPE-PUNCHING MACHINE can be manipulated by clerk in office after programmer has prepared tabular instructions. Tape and tool scheme are sent to shop floor with job order. After positioning preset tools and placing tape in machine, job is ready to run



The fire was a thousand miles away, so it wasn't any of your concern — until you found you had to close your plant because your biggest customer or your major source of supply was no longer in business. Here's how to protect yourself against such an emergency

EDWIN Q MORRISON, secretary, AGRICULTURAL & EMPIRE STATE INSURANCE COMPANIES, WATERTOWN, N Y

If your biggest customer suspends operations for any reason, what is going to happen to your business? Or if your sole supplier of a particular item is burned out, how are you going to continue making your product?

That's a problem to which too few manufacturers have given enough thought, as witness the fact that among 800 businesses surveyed, less than 1% had taken steps to protect themselves against such a contingency. Yet the answer is simple. You can obtain a special type of insurance, called Contingent Business Interruption insurance, that will take care of just such a situation. Most neglected and least understood of all industrial coverage, it will insure against any interruption of earnings resulting from fire or other specified loss by a supplier or customer.

As a case in point, half of Cramer Co's output was sold to one customer, Delta Industries. But Delta had a big fire and, for the time being, was out of business. As a result, Cramer had $25,000 worth of idle equipment and six skilled workers with nothing to do. Cramer was well covered against fire in its own plants, and consequent loss of earnings, but this fire was in a customer's plant and Cramer was not covered. There was only one thing to do — let six of the most-valued employees go, and distribute continuing overhead among the remaining business.

Or take the case of a manufacturer of home appliances. He buys a certain vacuum-formed plastic part made from a special grade of polystyrene sheet which is extruded by still another company. A fire at the extrusion plant would interrupt the vacuum-forming operation, and this, in turn, would halt assembly of the appliance. Such a contingency can be covered by the policy.

When GM's Hydramatic plant at Livonia burned down, there were several auto manufacturers dependent upon it for transmissions. Yet not a single one had insurance to cover the loss of earnings brought about by that fire. And a similar situation occurred some years ago, when a fire at Fisher Body forced production cut-backs at many automobile plants depending on Fisher to supply bodies.

On the other hand, a small New York foundry had to close down for several days when a bus crashed into a small sub-station on the property and cut off the power supply. The owner figured out what this cost him in lost earnings and collected from the insurance company under his business-interruption endorsement.

CHECK YOUR NEED

To determine whether you need this protection, list all possible exposures. And don't forget to allow for continuing overhead, such as salaries of key personnel, taxes, interest, depreciation, and advertising contracts. Consider whether you have perishable raw stock which could spoil in a few days or weeks. And if you have a seasonal operation, remember that a serious fire at the start of the season may mean the loss of the whole year's business. Consider the risks, and insure only where needed.

There is no standard policy. Each is individually tailored to suit the needs of a particular plant and particular hazards. But when you start to think about it, you may be surprised how vulnerable your business is. The US Chamber of Commerce reports that one big business depends on over 17,000 suppliers for its defense business alone. And just one product draws on 635 key suppliers, 80% of which are small businesses. By the same token, a single product produced by one company is the basis of 6000 independent manufacturing businesses. It doesn't take much imagination to figure out what would happen to all these businesses if the supply of this particular product were interrupted.

Think it over — but don't think too long.

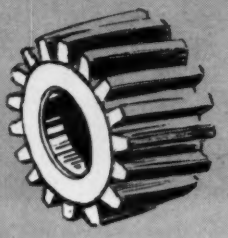
NEWS FLASH.....

FLINT---Buick is now automating two other lines--
for larger pinions-- in the same way as this one. Detroit
Transmission Division, G M C, is installing
a similar line...

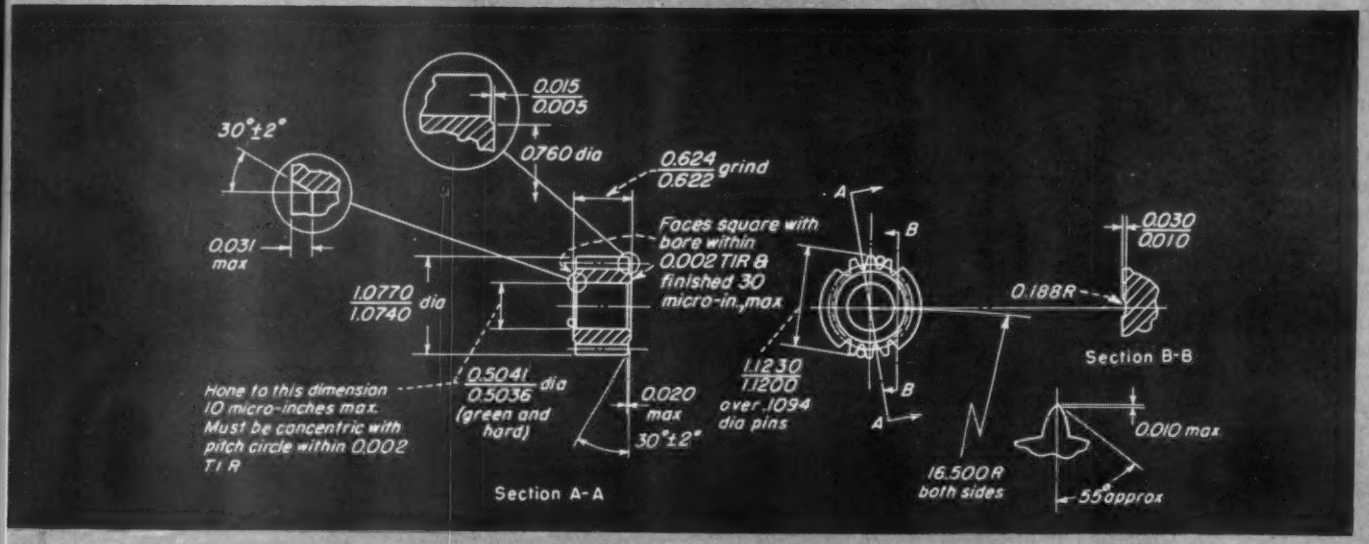
American Machinist

SPECIAL REPORT NUMBER 399

Automatic loaders, conveyors, inspection and sorting, tool compensation produce



GEARS UNTOUCHED BY HUMAN HANDS



GEAR DATA

No OF TEETH	16
LEAD	8.8008(RH)
BASE CIRCLE DIA.	0.8751
HELIX ANGLE	18°30'
PITCH DIA. (REF)	0.9373
ADDENDUM	0.0691
WHOLE DEPTH	0.1300
NORMAL DIAMETRAL PITCH	18
NORMAL CIRCULAR PITCH (REF)	0.1745
NORMAL PRESSURE ANGLE	20°
NORMAL CIRCULAR THICKNESS	0.0923
MAX SPACING ERROR ON CIRCULAR PITCH	0.0002
MAX LEAD ERROR	0.0005
MAX INVOLUTE PROFILE ERROR	±.0003
MESHES WITH MATING GEAR ON CENTER DISTANCE OF	1.8454
CROWN SHAVE	0.0002-.0004

CHAMFER ACUTE ANGLE 45° WITH C OF TOOTH .035 MAX FLAT. OPN: CHAMFER BOTH SIDES OF GEAR TEETH AT BOTH ENDS, 45° ANGLE WITH C OF TOOTH .047 MAX FLAT. CHAMFER MUST BLEND SMOOTHLY INTO ROOT.

Completely automatic processing of precision pinions has been developed at Buick Motor Div of General Motors Corp. Here's how costs have been cut and production increased by a line of machines that start with blanks and end up with finished gears . . . without manual handling. Frank Albro, an assistant master mechanic at Buick's Transmission Plant, and Roger Mitchell, general master mechanic of Buick Division, tell . . .

GEORGE H De GROAT, associate editor

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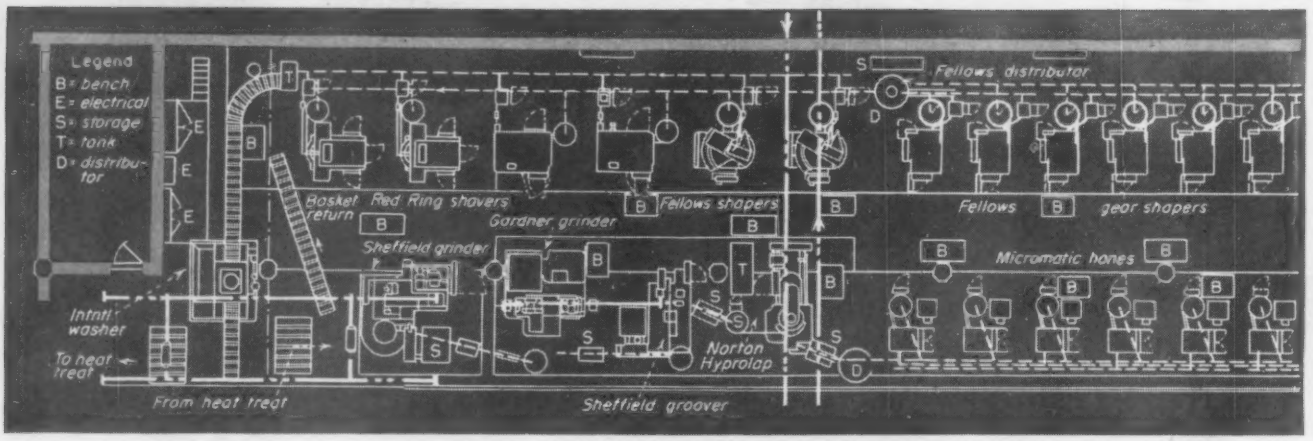


AUTOMATED PINION LINE starts with delivery of soft steel blanks to "green" line where OD's are ground, ID's bored, teeth shaped and shaved and parts finally washed. "Hard" line follows heat treat, includes grinding chamfers, thrust faces and oil grooves,

Automating a gear line presents many problems

Production of the converter planet pinions has been greatly increased as the result of Buick's new automated line. In addition, labor costs are cut by magazine loading, automatic filling of magazines by special hoppers, and automatic conveying of parts from one operation to another. Also important is the elimination of tedious and tiring manual handling of small gears, work baskets and the line.

Gears in modern automatic transmissions are much smaller and have finer pitches than those in previous transmissions. Being smaller, they are hard to handle, so loading time becomes excessive. Equipment formerly employed was primarily designed for larger parts, hence was not particularly suitable for the new pinions. Although automatic cycling and automation were among the answers, problems involved in automating the pinion line were considerably different from those in the more familiar transfer-type lines.

PROBLEMS VARIOUS AND NUMEROUS

Geometry of the gear was an important consideration. This converter planet pinion weighs only 1½ oz, has a nominal OD of a little over one inch and is about ⅝ in. long. Another consideration was the problem of distributing parts from fast machines to others where necessarily slower operations are performed. (This is in contrast to many automated lines, where all operations are balanced or the line is run at a rate to suit the slowest.)

Besides these problems, answers had to be found for such questions as:

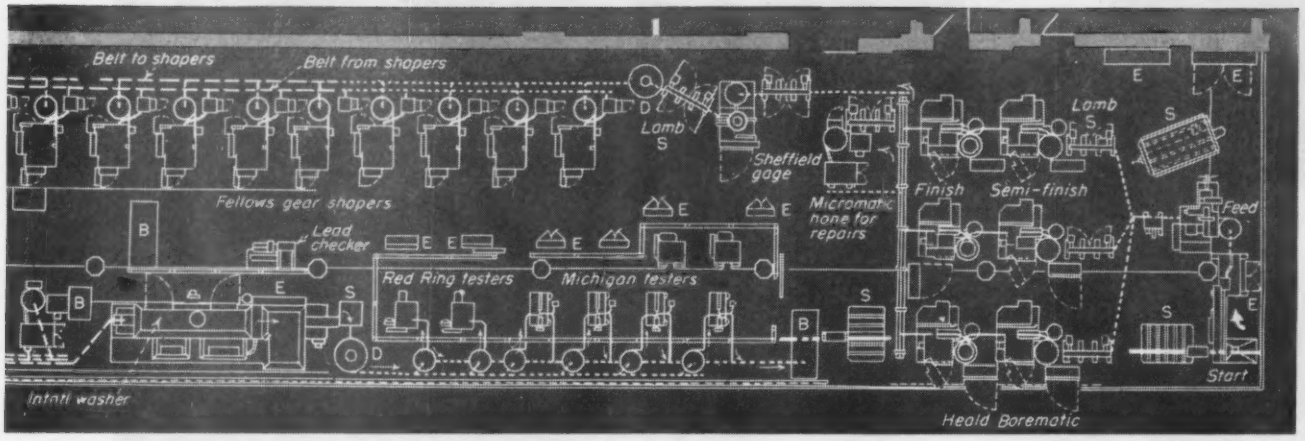
- Will the helical teeth entangle the parts with each other?
- Will the gear teeth catch on feed chutes?
- Will feed mechanisms have to be different for parts with teeth as compared with those for blanks?
- Will distribution be equal to each machine in a battery?
- Can distributing units be converted to handle more volume if production must be increased?
- Can distributing units be set up to feed only operating machines while bypassing a down machine?
- Will distributing units nick or otherwise damage the gears?

Answers to these questions naturally influenced selection of equipment and general layout of the line, but other considerations had their effect, too. For example, delivery time in some instances influenced choice of one make or type of machine over another. In this regard, shapers were selected for producing gear teeth, not only because they are suitable for that work but also because they were available for early delivery. Many of the machines installed, although made for the size range, are actually too big for the job and required some modification for magazine feeding and automatic ejection. It is believed, however, that the experience and results obtained by automating this line will considerably influence future designs.

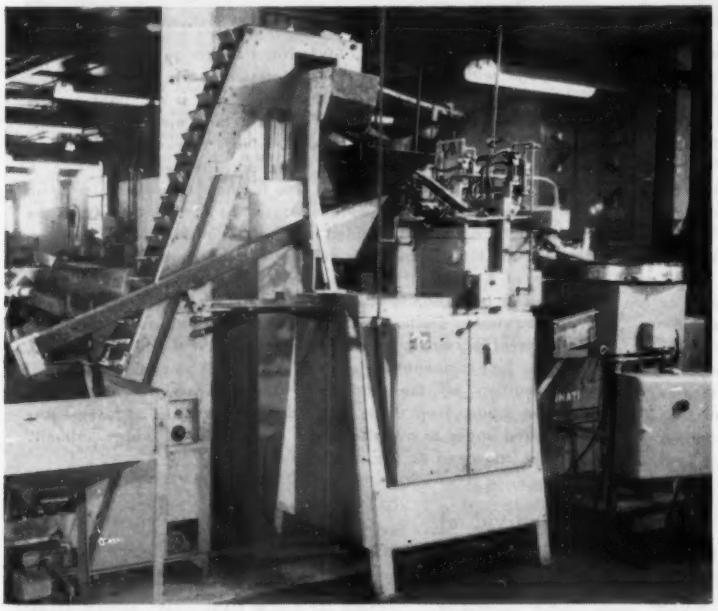
VIBRATORY FEEDERS AND DISTRIBUTORS IMPORTANT

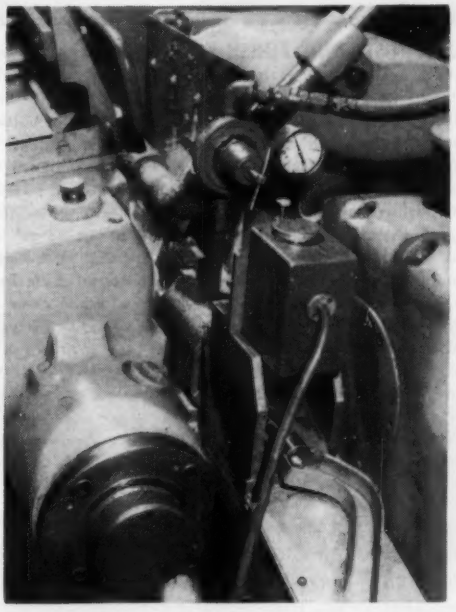
The problem of distributing parts to machines varying in capacity from 50 to 300 pieces per hour was solved by the use of Syntron vibratory parts feeders with large-diameter bowls. At distribution points where machine capacity is high, such as 300 to 2000 per hour, storage units are used, with the vibratory parts feeders employed as standby equipment only for use on such occasions as when trouble might occur in the distributors. With these units on each fast machine in the line and at distribution points, any machine can be idle for tool changes, setup, or other adjustment without affecting preceding or following operations.

Bowls are 24 in. in dia, and can be used for storage purposes because they easily hold 500 parts. As a result, the bowl on a relatively slow machine that is down may be fed by belt conveyor for several hours if necessary, storing parts received from the preceding



followed by honing bores, washing, gear speeding and final inspection. Throughout the line parts are automatically loaded and unloaded, gaged and sorted. All machines employ automatic work cycles, automatic work locating and holding, automatic compensation of tools (or wheels) to maintain size and automatic shutdown when consecutive rejects occur. Distribution of parts from fast single machines to batteries of slower machines is automatic too





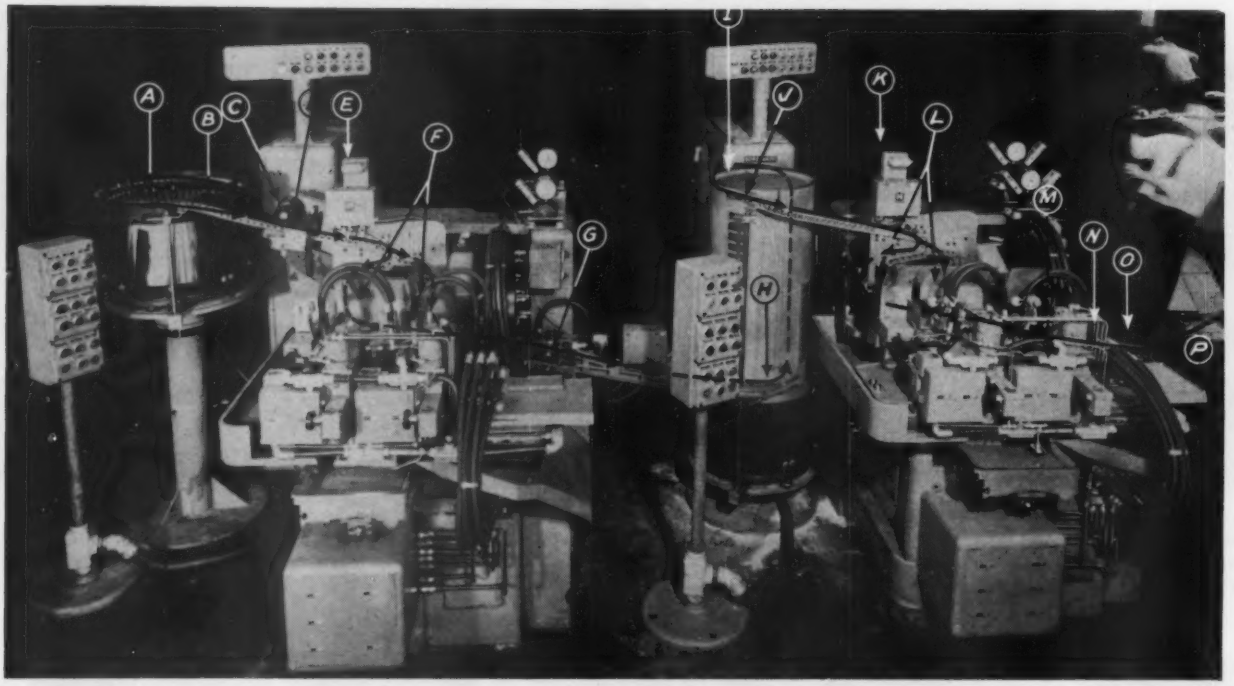
FIRST MACHINE in automated line is the Cincinnati centerless grinder to which inspected and sorted blanks are automatically fed for grinding OD's. A Rota-lift conveyor carries the blanks from a hopper to an inspection unit where they are checked for bore size, OD and length to prevent bar ends or other scrap from getting into the grinders. Blanks are then transferred to an Interlakes Engineering storage rack from which they are automatically metered to the grinders. After grinding, parts are again inspected, sorted, then ejected automatically. Wheel is automatically compensated to move in when blanks finish up oversize, moves out toward the work when they begin to run undersize: After a predetermined number of such compensations, wheel is automatically dressed

operation which continues to run normally. In the meantime, a following operation will not be held up because that machine can draw on the storage capacity of its own hopper.

In this type of hopper feeder, parts are moved slowly by vibrating action, up a spiral ramp around the inside of the bowl. They stop moving on the ramp when the vibrator is de-energized, (after the machine magazine is full) and instantly move again when the magazine needs filling and the vibrator is again energized. This is a particular advantage over other types (which feed a magazine fast and continuously and allow parts to fall back into a hopper when the magazine is filled) because the teeth must not be nicked or marked.

Certain specifications had to be met in bowl design to insure efficient feeding of oily gears without washing between operations. Among these was a pitch of 1½ in. per turn of the spiral ramp, a 3/32-in.-high rim rolled up on the inner edge to raise one side of the part and thus eliminate capillary action of the oil, and the use of a high amplitude of vibration.

De-energizing the vibrator as soon as a magazine is full prevents



SEMI-FINISH AND FINISH boring follows OD grinding and is done in a battery of six Heald Bore-Matics arranged in three groups of two machines each, one for semi-finish boring and one for finishing. General arrangement of each pair of machines is shown here with letters indicating sequence of operations. Blanks in Syntron vibratory feeder, *A*, travel through chute to *B* where a twist turns them from the horizontal to vertical position so they can roll down chute in correct position for gaging, loading and boring. Parts are mechanically gaged by a "go-no-go" plug at *C*, and no-go parts dropped out of line at trap *D*, balance continue through. Switch at *E* stays open while parts fill chute from *F* where they are automatically loaded into chucks. When chute is empty at *E*, switch closes to energize first Syntron which feeds parts for predetermined interval before it shuts off automatically. If no parts reach *E* in second cycle after the Syntron starts, the first Bore-Matic shuts off automatically and a red light on control panel indicates this condition. After boring, generating one face, and chamfering at *F*, the parts are ejected and roll down to the automatic gage at *G*. Here the boring bar is automatically compensated to correct bore sizes if parts come under or oversize, no change being made if bores gage within limits. If three successive parts are outside the limits, the machine shuts off automatically and a red light on the control panel indicates trouble. Parts are then ejected and transferred by a chute where, at *H*, a 90° twist places the parts in a horizontal position with finished faces up. The second Syntron, *I*, elevates the parts for gravity feed into the next Bore-Matic for finish boring after they are turned over again at *J*, this time from the horizontal to a vertical position so that unfinished faces are presented to the tools. Should the delivery of parts stop for any reason, a switch at *K* shuts off this machine. At *L*, two parts per cycle are finish faced and chamfered on the second face, then finish bored on the outstroke. Ejection follows to roll the parts down the chute to *M* where they are gaged as at *G* in the first machine. Here too, automatic tool compenation is provided, as well as sorting and automatic shutting off the machine if three consecutive out-of-limit parts are made. Trap doors at *N* and *O* eliminate and segregate parts bored under or oversize and *P* is the point at which "in-limit" parts are conveyed to the next operation

tight packing of the parts such as would occur in continuous or time-cycle operation of a vibratory hopper. Moreover, the operating noise is considerably reduced because only a few bowls in the line are running at one time.

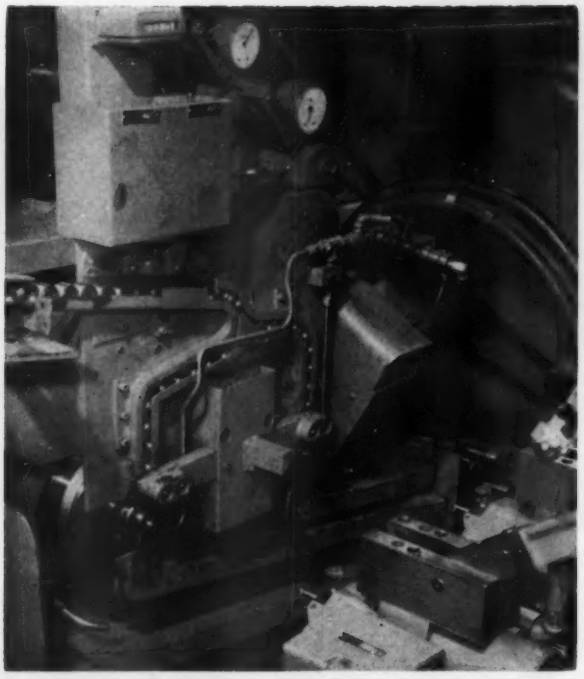
CHECKING SORTING AND DISTRIBUTING

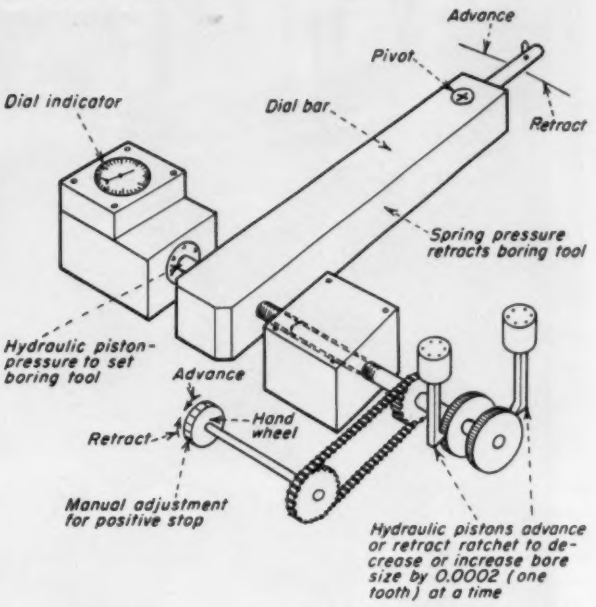
Great savings are gained and full automation enhanced by gaging the part automatically immediately after each operation with special built-in units. In some cases it was not possible to make the gaging unit an integral part of the machine, but even here they follow closely and are electrically connected to the machine. These devices also control sorting so those parts within limits are passed on to the next operation, while undersize and oversize parts are directed into individual receptacles for transfer to scrap or repair. In addition, the gaging units in some machines control compensating devices for automatic correction of wheel or tool wear.

Light panels on the gage-controlled machines indicate their performance. Red lights, for example, show that parts are running oversize, green lights indicate undersize, and amber means the machine is producing work within tolerances. By this means, a tool setter can quickly spot a machine that requires adjustment.

Distribution and special storage units between batteries of machines get the correct amount of work to the right places at the right time. One distributing unit for example, a Fellows device, consists of a Syntron feeder with a long conveyor belt running the length of 15 Fellows shapers. Deflectors on the belt admit only 10 pieces to each machine, more than this being passed around a guide and sent to the next shaper. When each of the 15 machines has 10 pieces loaded in the guides, parts are admitted to Syntron bowls on the machines. In this way, the machines can be loaded from either the storage bowls or the distributing unit, depending upon circumstances.

The distributor is set to count out 150 pieces before it stops feeding, (10 for each shaper) and can be controlled to feed less than this when a machine is down. Each shaper has a control station so, if one machine is down, the setup man pushes that control button and the distributor feeds only 140 gears to the line. As the guide at





TWO PARTS PER CYCLE is the setup in boring pinion blanks in 2-spindle Heald Bore-Matics. Automatic cycle is more or less standard, begins with rapid traverse of table which slows to bore in to a positive stop. A switch at this point is excited to start the cross-slide for generating the face and also to retract the gage rod slide to release previous parts. At the end of the cross-slide stroke, the table runs out at rapid traverse and chip strippers move out to clear the boring bars. When the table reaches the rest position, chip strippers retract and the cross-slide resets to the rear. The unloading chute then moves up, the parts are unclamped and ejected into it, after which the chute moves down and the loading arm carries two more parts out for insertion in the chucks. At this point, the gaging circuit starts, and ejected parts are checked for tool compensation. The chucks then clamp the work, and the loading arm moves out, up, and in to pick up two more parts. The table starts in for the next cycle and the sequence is repeated. Automatic tool setting, illustrated schematically, is controlled by a positive stop to limit cuts taken by boring bars, provides adjustments in bore sizes in increments of 0.0002 in.

the down machine is full, only the other 14 machines receive 10 gears each.

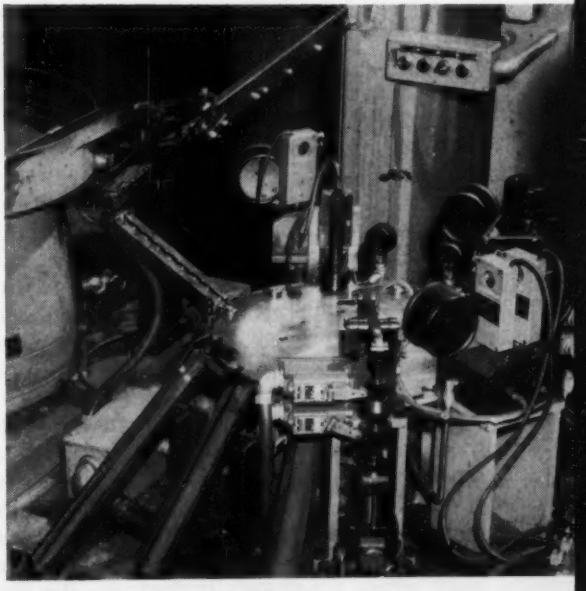
Other distributing units in the line work in essentially the same way and tie in with special storage units between operations. This compensates for unbalance where some machines are faster than others.

CHIPS AND COOLANTS

Automatic chip removal and coolant filtration became a necessity in this fully automated line —especially in areas where a large volume of chips and shavings are produced, as in shaping and shaving of gear teeth.

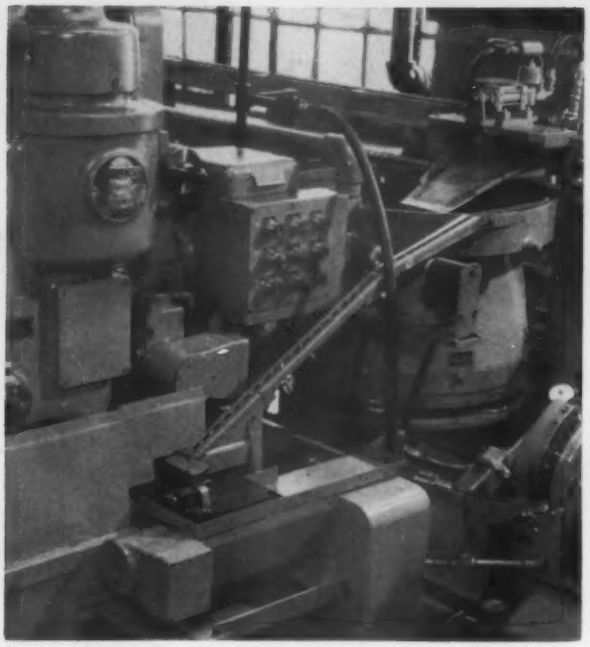
At gear shaping, chips and coolant are piped to a submerged central Hoffman filtration unit which removes the chips and returns clean coolant to the shapers. A separate Hoffman unit handles chips and coolants at six gear-shaving machines. Where it is found that a common coolant can be used in such grinding operations as chamfering the teeth, grinding the faces and oil grooves and in honing hardened gears—a central system handles the work.

AUTOMATIC INSPECTION of bored gear blanks precedes shaping. Work was transferred from Bore-Matics on powered double conveyor to a Lamb storage unit from which they were carried to a Syntron bowl on this Sheffield machine. Feeder automatically loads nests in the rotary indexing table which carries the parts around for inspection of parallelism, taper of bore, bore dia, and thickness. Light panel indicates results found at each of three inspection heads. An automatic sorting device segregates out-of-limit parts into repair or scrap pens and passes in-limit parts on to another Lamb storage unit and thence to a Fellows distributor

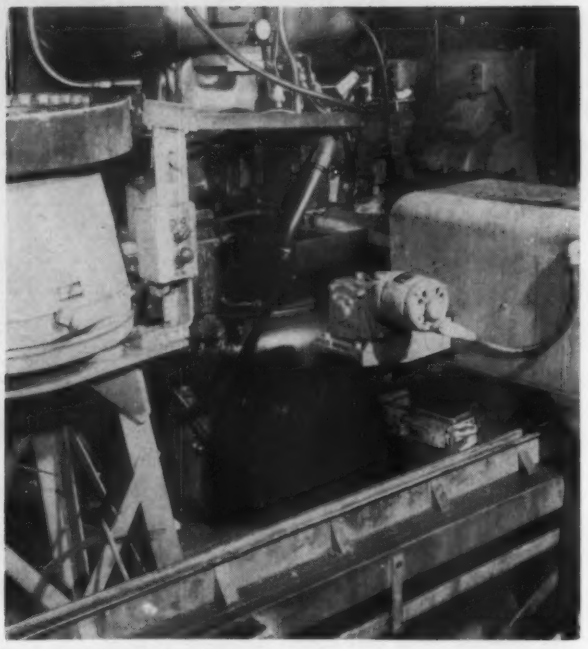


TRICKY MACHINE SETUPS

Ingenuity in machine design is by no means the least of the ways in which this automated line was made possible. Evidence of this is seen at the start of the line where, after SAE 1330 steel blanks are received from a battery of 8-spindle automatic bar machines, automatic inspection begins the process. Blanks are 1.081 to 1.086-in. OD, 0.647 to 0.653 in. thick, and have bore dias of 0.478 to 0.483 in. These



GEAR SHAPING is automatic too, requires only two job setters for 15 Fellows machines. Belt conveyor from distributors runs along entire line of shapers and has deflectors that admit only 10 pieces to each machine. When all 15 have 10 pieces in their loaders, parts are delivered to Syntron storage bowls. Work is removed from the loaded magazine by a pickup finger that places it on an expanding arbor where a ram seats it in position under the cutter, ready for shaping. Ejection is accomplished by means of the same finger which places the finished gear into a track for transfer to an air fixture where loose chips and oil are blown off. Automatic inspection of gear tooth size is handled by the gaging unit on the right, (shown with the cover open) where the parts are run in mesh with driving gears and a gear section. Automatic sorting occurs here too, and parts within limits are passed through a deburring unit and placed on another section of the conveyor for transfer to the next storage and distributing units



ONE OF SIX SHAVERS, this "Red Ring" machine, like the others, is equipped with a Syntron vibratory feeder, an automatic loader, feed magazine, an "out" gage, a sorting device, and a discharge unit. Shaved gears are carried from a storage unit, then to a distributor which supplies the Syntron bowls on each shaver. Parts are fed into the automatic loader which places the gear between centers for shaving a 0.0002 in. crown, removing approximately 0.0005 in. of stock from a side. After shaving, the gear is automatically unloaded into a small washing unit for cleaning before it is gaged. Salvageable gears out of limits are sorted into one pan, rejects into another (for repair), while parts within limits are directed into the belt conveyor in the foreground for transfer into baskets for washing

are loaded into a hopper that feeds a Rota-Lift conveyor which transfers them to the inspection unit. This actually operates as a protection gage to prevent bar ends or other bad stock from entering the automated line.

Here thickness is checked and the blanks are sorted automatically according to bore size as a means of protecting a boring and facing operation later. Those within tolerance are conveyed to a Syntron bowl which automatically feeds a No. 2 Cincinnati centerless grinder. The OD is ground here, to 1.075-1.076 in.—being held this close for chucking in the boring and facing machines. Finished parts are again automatically gaged and sorted upon ejection. Another feature of this machine is a compensating device controlled by the sorting unit to adjust the wheel when parts run out of limits. The wheel is moved out according to requirements when gear OD's are undersize, and is moved in toward the work when the blanks are oversize. The wheel is also automatically dressed after a predetermined number of compensations for wear.

Transfer of the ground blanks to a Lamb distributor and three Lamb storage units permits storage and equal distribution to six two-spindle Heald Bore-Matics arranged in three batteries of two machines each. First machine in each battery semi-finish-bores the part to a 0.002-in. limit, (0.492-0.494 in.) and generates and chamfers one face, while the second finish-bores to a 0.0008-in. limit and generates and chamfers the opposite face. Squareness of the face with the bore within 0.0002-0.0004 in. is necessary for locating when cutting the teeth later. Conveyors from the storage units feed the first machines. From the storage racks, the gears enter chutes in which a 90° twist positions them properly. This position also permits them to roll for gravity loading down two 2-ft-long chutes into a heart-shaped division over the two spindles on the machine.

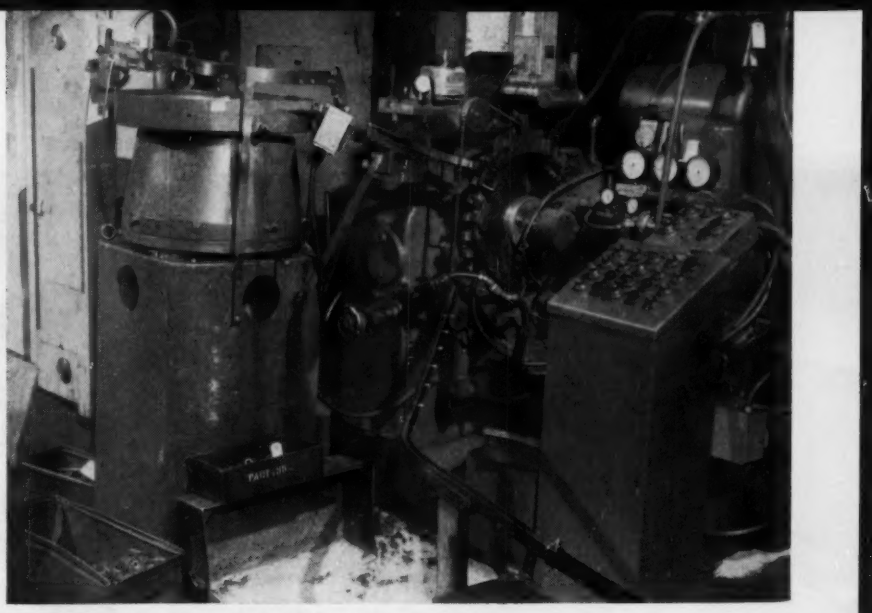
Two parts per cycle are run through each machine, both pieces being picked up by automatic loaders (one for each spindle) which load them into two diaphragm chucks. Chucks close to locate and hold parts for machining, while loaders retract and return to a stationary position in front of chutes ready for the next cycle. After loading, parts are

faced, bored, and ejected. The semi-finishing setup inbores to a positive stop, after which the boring bar retracts and then moves out.

Tooling consists principally of two cam-actuated tool slides mounted on the cross-slide pad for facing and chamfering operations, and two dial-indicator bars bridged over the cross-slide for boring and chamfering. Each dial bar also carries a hydraulically operated stripper for removing chips that might wind around the boring bar. The strippers operate every cycle after the table has run out to rest position, and parts are ejected from the chucks into individual gravity-feed chutes which transfer them to an air gage station. Here the gaging unit only controls compensation of the boring tool to maintain size within the 0.002-in. limit, as parts are finish-bored to final limits on the second machine.

Automatic setting of boring tools occurs during the loading and facing cycle and is accomplished by a positive stop. This stop limits the cut taken by the boring bar, and is threaded for adjustment to increase or decrease the cut. Either of two ratchets attached to the screw makes the adjustment, actuated by hydraulic cylinders. Cylinders, in turn, are operated by the air-gaging setup. When the air gage indicates that a gear bore is small, the valve is energized to operate the cylinder, thus the ratchet for backing off the adjusting screw, so the boring bar is advanced to produce the next-larger-size bore. When the gage indicates bores are oversize, the procedure is the same, except that the other ratchet is actuated to adjust the screw in the opposite direction.

After gaging for compensation of the tool if necesary, semi-finish bored parts are transferred to storage units at the second machines, where the procedure is much the same. For finish boring, however, these machines are set up for rapid traverse in with the boring bars retracted. At the positive stop, the cross slide generates the opposite face of the blank to a second positive stop, after which the boring bar is moved into operating position, the hole is chamfered, and the bar finish-bores out.



AFTER WASHING hardening, and grinding chamfers on the teeth, gears are automatically loaded into this Gardner grinder for grinding thrust faces. Work is transferred from a Lamb storage unit directly into the grinder although a Syntron bowl and feeder is also employed for standby purposes. Automatic wheel compensation is provided here, too, when parts run out of limits. Ground parts are gaged in the carrier, sorted, and ejected into discharge chutes for repair, scrap, or transfer to the next operation

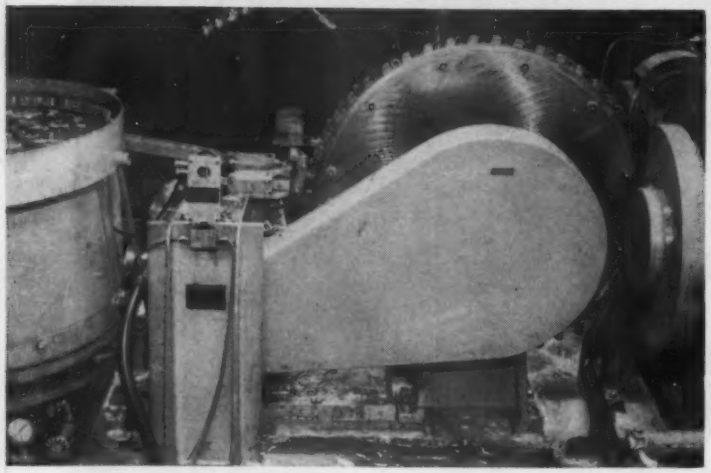
As in the first machines, two parts are handled per cycle, both being plugged simultaneously for air gaging the bore. Here, the air gage not only checks and sorts the parts within a limit of 0.0008 in. (0.5018-0.5026) but also compensates the boring tool within a limit of 0.0005 in. A panel shows a green light when undersize parts are made—one amber light indicates the tool is compensated for working on the low limit; another amber light shows it has been compensated downward for being on the high side. A red light indicates oversize work. If the boring tool in these machines is set wrong or breaks, so the air-gage spindle cannot enter the bore—it is protected by being mounted in a spring-loaded cartridge and automatically shuts the machine off. Under these conditions, too, a red light on the panel indicates gage interference to warn the job setter of the situation.

REPAIR AND INSPECTION BETWEEN OPERATIONS

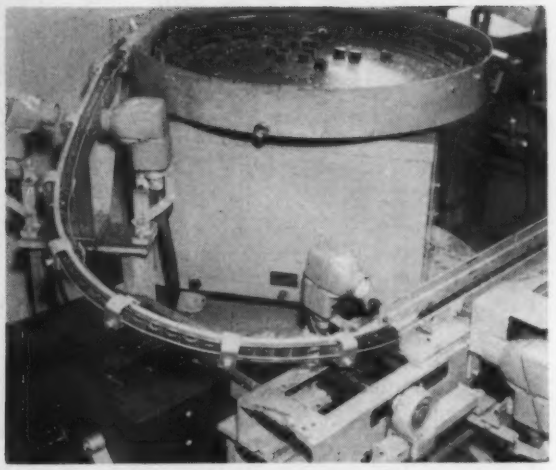
Work from the Heald machines goes to a powered double conveyor for transfer to a Lamb storage unit from which it is fed to a Sheffield automatic gage. Parts being sorted, however, permit one side of the double conveyor to be loaded with "in-limit" parts for this operation, the other side with undersize parts which are transferred first to a Micromatic hone for repair. Oversize parts are ejected from the Heald machines directly into pans from which they are checked for salvage or scrap. After honing, automatic gaging, and sorting at the Micromatic machine, repaired parts are delivered to the conveyor for transfer to the gaging setup along with the others.

At the Sheffield machine, blanks are automatically loaded, then checked for thickness, bore size, parallelism of faces, and taper of bore. This setup also has an automatic sorting device so parts that pass the rigid inspection are transferred to another Lamb storage unit preceding a gear-shaping installation, while rejects are disposed of by scrapping or repair, depending upon their condition.

Next step in the process is to produce the gear teeth. This is done in a battery of 15 Fellows shapers fed from the Fellows distributing unit previously described. This in turn receives blanks from the Lamb storage unit following the Sheffield gage. A pickup finger on each shaper takes a blank from the magazine and loads it on an expanding arbor, after which a



GROOVE GRINDING follows face grinding and is done in this automatic Sheffield machine. Here two Pope spindles drive two grinding wheels between which the gears are carried by a "ferris wheel" rotary fixture. Parts are loaded into the carrier directly from a storage rack—Syntron vibratory feeder is a standby device. Parts are ejected into a chute immediately after grinding because no inspection is needed on the oil groove dimensions. Automatic compensation for wheel wear and an automatic dresser are provided

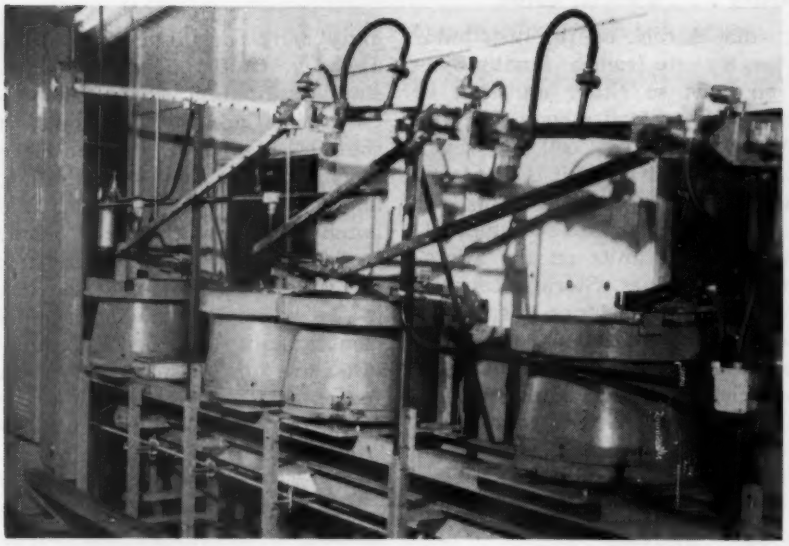


TYPICAL DISTRIBUTING UNIT is this Interlakes Engineering device that supplies gears to Lamb Hitchlift for transfer to a battery of six Micromatic hones through a chain-belt conveyor that runs the length of the line of hones as long as parts are not backed up to the photo-electric cell at the point where work enters the conveyor. When this happens, the cell stops feeding. Moreover, it controls opening of gates along the conveyor at the honing machines. In this way, Syntron bowls on individual hones are loaded as needed and the feeder is not running constantly. Syntron bowl at the head of the line is a standby

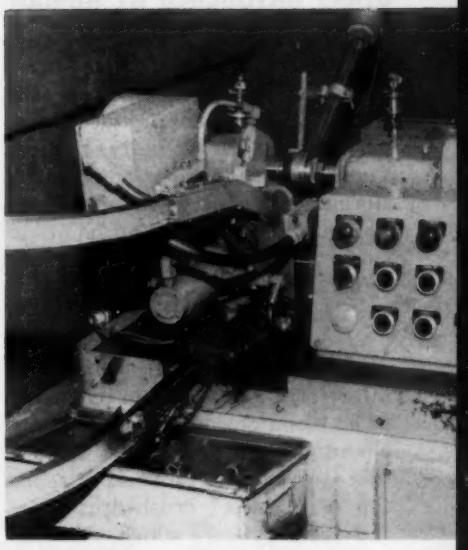
ram seats the blank in position for shaping. The same pickup finger also ejects a finished gear into a track that carries it to an air fixture that blows off loose chips and oil. After air blow-off the finished gear rolls down a track, passing a photo-electric cell that starts an automatic inspection device through which the gear is carried by an internal sector for one revolution. This provides a "high-tooth" check, after which the gear goes to a smaller sector, at which time the rotary motion stops. Here a master gear pinches the cut gear against the sector to check it within a limit of 0.002 in. over wires.

Work is then ejected from the gage, with undersize and oversize parts being directed into separate pans. In-limit parts continue on to an automatic deburring fixture which removes the heaviest burrs so faces may be used for locating surfaces in a following chamfering operation at the end of the teeth. Here, again, shapers are automatically stopped and a warning light turned on if three consecutive parts are made out of limits. Parts within limits roll out of a chute to lie flat on a power-driven "take-away" belt for transfer to the next storage and distributing units. For larger gears, batteries of gear-hob-

AUTOMATIC HONING is accomplished in Micromatic machines equipped with Syntron vibratory feeders. Each is supplied from a track, (seen behind the spindle) fed from a conveyor running the length of the line (lower right foreground). Work from the vibratory feeder enters a chute in which limit switches start and stop feeding action, depending upon the level of parts in the chute. When parts drop onto the work table, a plunger places them in a fixture under the work spindle at the same time a finished gear is positioned under the mandrel of an air gage for checking. The table is automatically raised for the honing cycle which is automatically ended when the gear bore reaches required size. This is done by means of a control using a special abrasive in the tool as an expanding plug gage which initiates an impulse to an electronic circuit that starts the cycle-termination sequence. At the start of the honing cycle, a finished gear is slipped over the mandrel of an air gage and the true dia of the bore indicated on a dial. Two Airlectric gage heads control four pilot lights, for warning, oversize, and undersize, and two segregation gates to three chutes. The lights indicate whether oversize or undersize, or in-limit parts have been made, and such parts are shunted into their respective chutes. Warning lights indicate parts within 0.0001 in. of either limit have been made. If three consecutive parts are rejected, a counter on the segregation gates shuts the machine down. When the abrasives are worn out, a switch stops the machine



ORIENTING THE GEARS after honing and washing is accomplished in a Lamb storage unit that delivers them to a distributor. From the distributor, the gears are delivered to Syntron vibratory feeders that automatically transfer them, upon demand, to a battery of gear speeders inside a soundproof room



GEAR SPEEDING to test for nicks by the sound of gears running together, is automatic, too. Here a Red Ring machine is fed parts from a Syntron bowl outside the room, the gears being loaded directly from the feed chute running through the wall. A photoelectric cell in the chute stops and starts the Syntron feeder here, too, depending upon the level of parts in the chute. One gear at a time is held on an expanding arbor and enters into engagement with a master gear. It is then run in one direction for a predetermined length of time, and a brake load automatically applied, after which it is run in the opposite direction and the load applied again. Automatic unloading follows, and gears that pass the test are re-directed to the conveyor for transfer to final assembly. Rejects are directed to a chute in which they are accumulated for repairs

bing machines are set up in essentially the same manner.

SHAVERS ARE THREE DIFFERENT MAKES

Transfer of the gears to a storage unit and a Fellows distributor precedes the next operation where six shavers are installed. Two are Fellows machines, two others are Michigan rotaries, and the last pair are National Broach "Red Ring" machines. All, of course, are automatically loaded, operated and unloaded. About 0.0005 in. of stock is removed from each side of the teeth, amounting to a measurement of 0.003 to 0.004 in. over pins. A 0.0002-in. crown is produced. Each machine is equipped with a Syntron vibratory feeder, feed magazine, an automatic loader, an "out" gage and sorting device, and a discharge unit.

In general, the sequence of operations is to pass a gear from the vibratory feeder to the automatic loader, where it is located in cutting position. After the cutting cycle, an automatic unloader removes the finished gear and transfers it to a small washer which cleans it before it enters the "out" gage, where size and helix angle accuracy are checked.

As the gears roll down a chute into the gage, two master gears are contacted. These are spring-loaded and set close for center distance. One master is locked to prevent rotation, but it can swivel on a trunnion so that any variation of helix angle will not affect the pitch dia, (size-over-pins-check). The opposed master rotates slowly, pulling the gear to be checked between the two masters which are thereby spread apart. If they do not open sufficiently, a low-limit gate opens to eject that part, and if they spread too far, a high-limit gate opens to eject it into an oversize pan where parts with the helix off are also deposited. The gates remain closed for in-limit parts which pass out to a belt conveyor for transfer to the next operation. This gage also shuts the job down if three consecutive gears fail to pass inspection. A system of warning lights indicates the type of error, so a job setter can see the trouble and quickly make necessary adjustments. Furthermore, this device sorts salvageable rejects from those that cannot be salvaged.

"HARD" LINE FOLLOWS "GREEN"

At this point the automated line becomes slightly less automated, the influence of the Livonia fire which resulted in the prohibition of heat-treating setups under certain conditions. Because heat treating could not be included in the line and it is necessary to wash the gears before hardening, an International batch-type washer immediately preceding heat treat employs baskets so gears can be conveniently moved to the heat-treat department, hardened in a Dow batch-type furnace and returned to the line. The entire line preceding the hardening operation is referred to as the "green" line, the section that follows is known as the "hard" line, and it is here that grinding and honing operations are performed.

Automation in the hard line is

just as extensive as it is in the green line, however it has more high-production equipment where only one unit can produce more parts than are actually needed. These require installation of Lamb storage racks between operations as well as at distribution points to slower operations.

This line begins with a Sheffield chamfer grinder automatically loaded intermittently by means of a Syntron vibratory parts feeder filled from a storage bin by means of an elevator conveyor. Gears are chamfered at tooth ends on one side by rolling them across the top of a wheel crush-dressed to the tooth shape, which also removes the burrs. Chamfering teeth on the opposite face is accomplished by automatically turning the gears over and rolling them back across the bottom of the wheel. No gage is used in this operation.

DOUBLE-DISK GRINDER

From a storage unit, gears are delivered to a Gardner double-disk grinder equipped with a standby vibratory feeder. In this setup, gears are clamped in U-slots in a carrier by means of an endless belt. The carrier rotates between two grinding wheels to which parts are carried for semi-finish grinding thrust faces on both sides. Ground parts are gaged in the carrier and ejected into discharge chutes. Compensation of wheel position is automatic when three consecutive parts run out.

An automatic Sheffield groove grinder then produces oil grooves in both faces, being loaded from a storage unit with a Syntron vibratory feeder maintained as a standby. This machine is also equipped with an automatic wheel dresser and has means of automatically compensating for wheel wear. Because no great accuracy is required in the size or location of oil grooves, automatic gaging is unnecessary and parts are discharged from a "ferris-wheel" rotary fixture directly into a conveyor that delivers them to another storage unit.

This unit distributes parts to a conveyor that feeds a battery of six Micromatic hones where bores are finish honed to 0.5036 - 0.5031 in. dia. A rack on the distributor joins a chute from a standby Syntron bowl so either unit can be employed to load a conveyor belt. A photo-electric cell, however, stops the belt when it is filled and at the same time controls the opening of gates that feed individual Syntron units on the Micromatic machines. Storage capacity of bowls on machines is sufficient to permit continuous automatic operation, and, here again, limit switches on each machine start and stop the Syntron feeders, depending upon the level of parts in the feed chutes. Pushbutton setups permit bypassing when a machine is down.

Each machine automatically positions the work in a fixture. As a part drops on to the work table from the chute, a plunger places it in the fixture at the same time a finished gear is positioned for automatic checking. The machining cycle is automatically ended when a gear bore reaches the desired size by a control that initiates an impulse to an electronic circuit which starts the cycle-termination sequence. Automatic size control actually holds bore sizes within a 0.0003-in. limit 95% of the time. When new abrasive stones are wearing into shape, however, size may go 0.0002 in. more either way. For this reason it is not practical to operate a machine to the middle of a 0.0005-in. total limit, so it is set to produce holes from the low limit to 0.0003 in. above. In this way, 0.0002 in. more is acceptable and only very few parts run 0.0002 in. below. The machine is set to hone to a limit of 0.5036-0.5039 in. 95% of the time, and the gage sorts parts to a limit of 0.5036-0.5041 in.

GAGE AND HONE TOGETHER

When a part is placed in the fixture and the table raised to start the honing cycle, a finished part is slipped over the mandrel of an air gage. The exact diameter is then indicated on a dial. Two Air-lectric gage heads control four pilot lights and two segregation gates to three chutes. Lights indicate whether the part is oversize, undersize, or for warning, within 0.0001 in. of either limit, while gates shunt parts into one of three discharge chutes, depending upon their condition. If three consecutive parts are out of limits, a counter on sorting gates shuts the machine down and, in addition, another control stops the machine automatically when the abrasive tools are worn out. Undersize parts are collected in a pan at the end of the battery and, when a sufficient quantity has been accumulated, are dumped into the Syntron feeder of the last machine to be rerun through honing. Oversize parts are collected at each machine for salvage sorting. Parts within limits are conveyed directly through an International belt-type washer where they are washed, rinsed, and blown off.

SOUND TEST FOR NICKS

After washing, gears are conveyed to a storage unit where they are oriented, then delivered to a distributor that feeds six automatic sound-testing machines, equipped with standby vibratory bowls. Two of these are National Broach "Red Ring" gear-speeder inspection units, four are Michigan machines. Here each gear is spun with a master gear so the resulting sound indicates whether or not there are small nicks in the teeth, or (by a high-pitched whine) there is an off-lead condition.

The distributor operates intermittently, depending upon the load in the input chute, and one gear at a time enters into engagement with a master gear. When a gear is loaded in the speeding position, a finish-tested gear drops into the unloading chute and is returned to the conveyor. An expanding arbor automatically enters the gear bore during the loading cycle to support it during test. In testing, the gear is run in one direction for a predetermined length of time, and a brake load automatically applied, released, and the gear run in the opposite direction. The load is automatically applied a second time, after which master-gear rotation is stopped and the loader is cycled through its load and unload functions. Repairs to rejected parts, final inspection of bores, and automatic delivery from the line finish the process.

Round Table

Pull, Brothers, Pull

"Where'd you get that new man, Ed; from a bakers' school? He's all thumbs, and not too bright."

"You're dead right, Al, but I don't dare tell Harrison that."

"Why tell Harrison; why not fire him?"

"He's one of Harrison's pets, Al. What can I do? Belongs to the same lodge or something—they're old buddies."

"Is that why Harrison canned Riley a couple of weeks ago—to let his pal in?"

"Well, I don't think Harrison had this guy in mind at the time. Actually, he was really mad at Riley—and had a right to be, too. But it just happened that this duffer came along about the same time and asked him for a job, so Harrison put the bee on me."

"That's pretty low stuff, Ed. I don't suppose you can get any satisfaction without getting into trouble; but I wouldn't let the guy get away with anything."

"Oh, don't make too much out of it, Al. I've had a lot tougher problems. If Harrison wants to put in a pet, he's just using his rights as Supervisor, I suppose."

"Rights, hell, Ed! Why does he have any right to hire some old friend, when we can get a man we know is good just by advertising?"

"Well, in the first place, even Harrison wouldn't dare put the pressure on me to hire a pal if he wasn't at least a passable machinist. This goat's no expert, but he's at least familiar with machines. He'll do."

"Yeah, I can tell by your tone of voice that he's really a dandy."

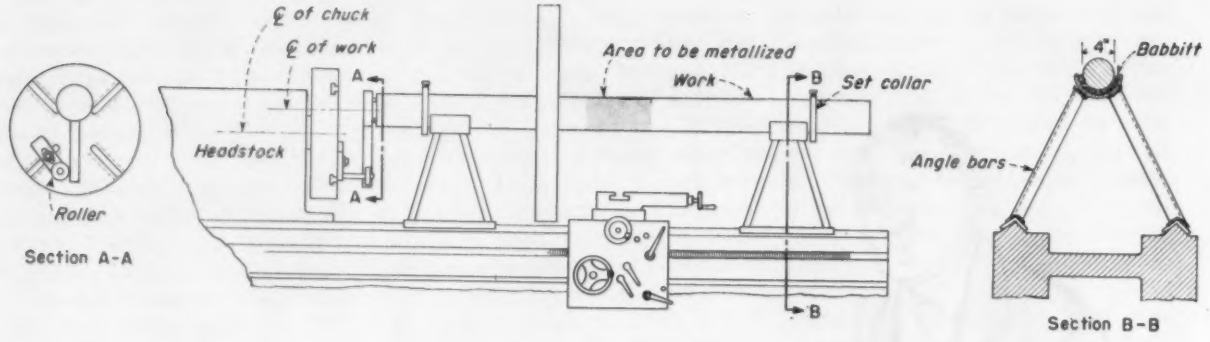
"Besides, Al, I may want Harrison to do me a favor or two someday, and if I help him out in this case, he's obliged—in a way—to help me when I yell."

"I'm not sure I'd trust a man who'll pull a deal like this to stick by me if the going gets rough, Ed."

"Listen, Al, you'd better remember who OK's your purchasing requests, and act accordingly."

***SHOULD** you resist favoritism on the part of the boss? Is it smarter and safer to go along with him—even if it costs you production? Should a supervisor have the right to ask a foreman to take on a friend of his? Your opinions may help others. Discussions of earlier topics start on page 158*

Practical Ideas . . .



Angle-Iron Support Holds Turbine Rotor

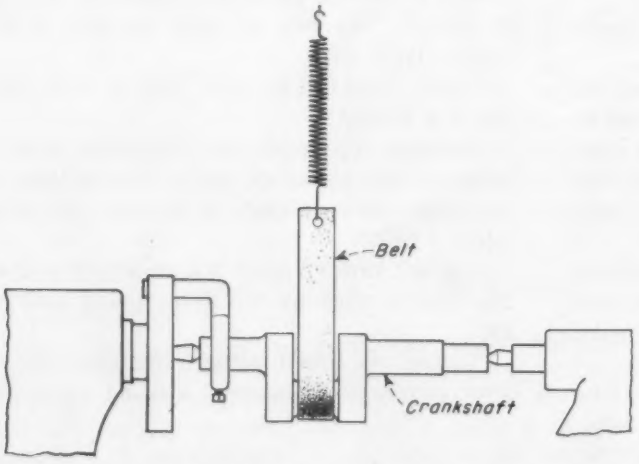
In our job-shop repair work, we often have problems because of work that is too large for our equipment. One such case is shown here, where we had a turbine rotor which was 2 in. larger in diameter than the swing of our largest lathe. We had to spray-metallize a part of the shaft which had become damaged.

Of course, we could have used the same setup to machine away part of the shaft, if that had been necessary, before metallizing.

To swing the work, the angle-iron support was built. We fabricated two temporary steadyrests with split pipe welded in place to hold the shaft. The rests were placed in position and the shaft was swung into place. Molten babbitt was poured into the pipe sections, to form a bearing. Set collars were provided to prevent end-play. No bearing caps were needed, as the weight of the work was enough to keep it in place.

Driving was done by tack-welding a square bar of finished steel to the end of the shaft. A stud bolted to the lathe faceplate carried a ball bearing which rolled back and forth against the bar on the end of the shaft.

When pouring the molten bearing metal on the pipe sections, we find that it is best to rotate the shaft one half revolution as quickly as possible, to equalize heat and prevent distortion. *H M James, owner, James Machine Works, Monroe, La.*

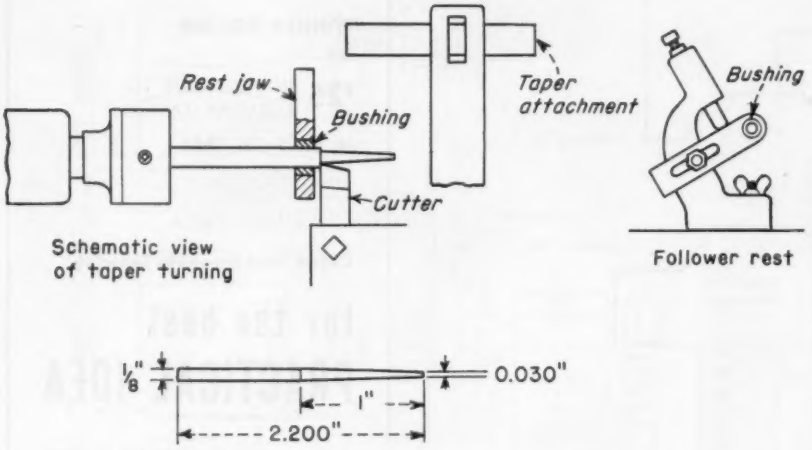


Spring, Belting, and Emery Cloth Help Polish Crank Pins

We have a number of punch presses, in which we have been installing new bearings. On some of these tools, we found that the crankshafts were scored slightly at the main and crank pin bearings.

We could polish the main bearings directly by putting the part on centers in a lathe, but this left the crank pins undone. To polish these, we mounted a long spring over the lathe, and attached a piece of leather belting. The loop of belting was the same width as the bearing. A strip of emery cloth was secured to the belting with a small C-clamp, and the belt was looped around the crank. Turning the part slowly finished the job.

The emery cloth was shifted to a new section or changed to a finer grit as needed. A little oil applied to the cloth made smoother cutting. *H Koslow, Bronx, NY*

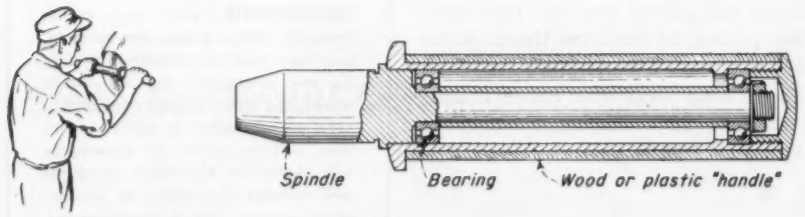


Bushing Aids Turning Small Taper On Long Thin Steel Needles

We had to turn a number of needles from ground ⅛-in. drill-rod. As a suitable machine (such as a Swiss automatic) was not available, we made the work in a small lathe equipped with a taper-turning attachment. To permit turning the thin work, we borrowed the feature of the automatic —a guide bushing ahead of the cutter.

The regular jaw of the steady-rest was replaced with a longer one which had a hole for a hardened steel bushing. The hole of the bushing had been lapped to a snug running fit for the drillrod.

The bushing was adjusted to the centerline of the work, and the cutter was placed close to the bushing. Then the work was taper-turned in one pass. The rod was lubricated with cutting oil. *M Barash, Haifa, Israel*



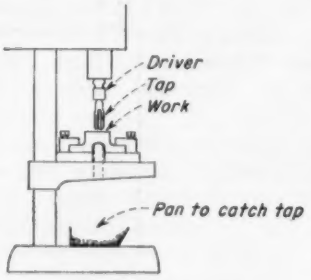
Handles For Polishing Tubes

Polishing brass or iron pipes before nickel-plating or chrome-plating is easily handled with this simple device, which consists of two specially designed handles. One handle is inserted in each end of the workpiece which is to be polished.

The steel spindle is assembled with the two ball bearings, a spacer pipe, and a locknut. Outside the housing is a thin wooden handle.

The work is put between the two handles and held against the buffing or polishing wheel. By experimenting a little bit, the proper angle can be found so the work rotates at just the right speed for best results. *Hjalmar Dahl, Upplands Vasby, Sweden*

Water-soluble cutting fluid is sometimes used when cutting magnesium. But, besides the fire hazard, this practice leads to trouble holding size on larger work. The variation in temperature makes it hard to know just how much the work is going to heat up (and expand) during cutting. *G Wernberg, Batavia, NY*

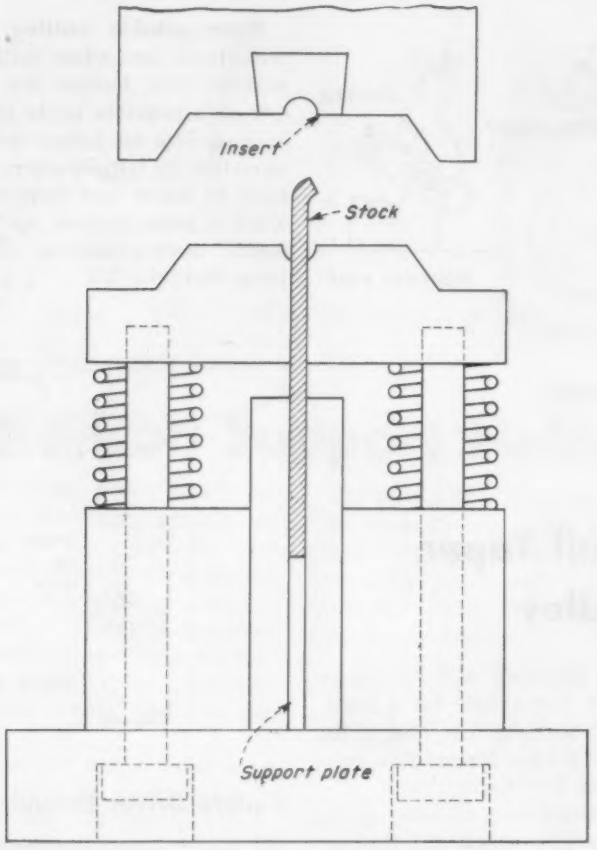


Square Driver Extends Tap

We had to tap some deep holes in an adjusting block, and needed every bit of the length of the tap. The holes had to be perfectly square with four machined sides of the work, so we rigged a tap driver to fit the tapered spindle of a slow-speed drill. We milled a square 0.005 in. larger than the square shank of the 1½-in. 8-pitch tap, and sweated the square driver to the milled sides of the taper spindle.

With this driver, when the drill-press hit its stop, the tap fed on downward until it ran out of the box, at which time it had only about ¼ in. of thread in the bottom of the threaded hole.

The tap was fed out through the bottom of the work into a padded box. *Frank W Smith, Rossville, Ga Ed note: This method is good, even if you don't need the entire length of the tap. Large holes are hard to tap in certain aircraft steels, because the tap tears when it is being backed out of the work. Simply driving the tap on through the work is a quick remedy.*



Die Curls Aluminum Hinges

More than 12,000 aluminum hinges were made with this simple curling die. The hinges were 12 in. long, made from 24ST sheet stock. The material was first notched to size, then a small radius was bent in the end of the notches.

The next step was successive curling in the die shown. The design is such that the insert can be changed for the different diameters of curling. The size of the plate supporting the work was determined by the thickness and width of stock.

The hinge was completed when a pin was placed between two curling pieces, to combine them. After the first run, other hinges less than 12 in. long were also made in this manner. *Hsu-Tsung Hwa, Taichung, Formosa*

Acid-Etching Usage

Nitric acid diluted half and half with water is a simple and effective etching solution for hardened steels. Besides marking pieces, the solution can be used for slightly reducing the size of small drills, and decreasing tap diameters when the tapped fits are too tight. Dull files and burrs—especially the finer cuts—are restored to almost original sharpness when mildly etched.

Also, a superfine file, such as a jeweller's file, can be made by grinding away and then etching the teeth of an ordinary file. The resulting tool can be used for extra-careful toolmaking jobs.

Springs should not be etched, because local hard spots are caused, probably by hydrogen embrittlement. *M Barash, Haifa, Israel*

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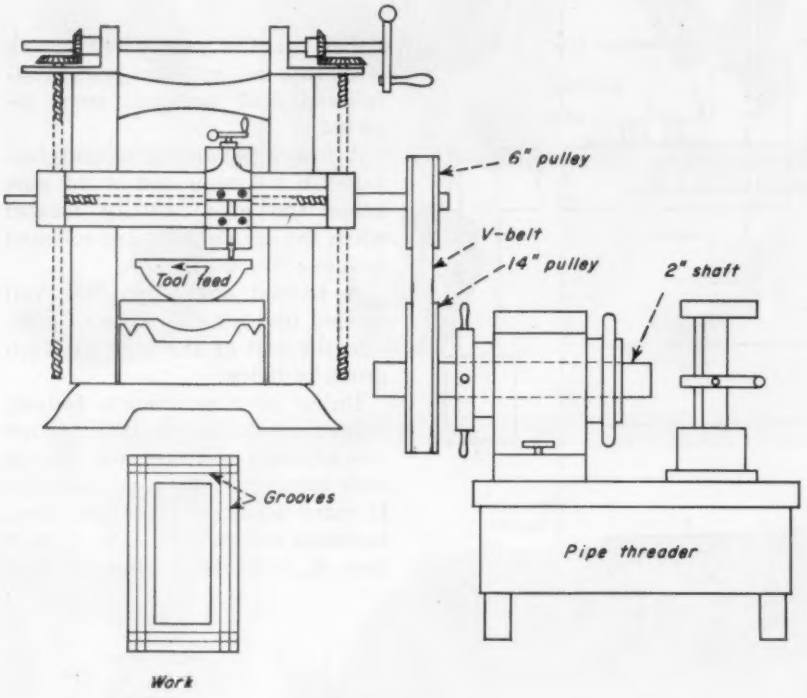
WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y



Pipe Threader Drives Crossfeed To Plane Casting Grooves

We had the problem of planing four grooves in the bottom of a casting which was pointed on the bottom, and awkward to handle and set up. We planed the two lengthwise grooves without trouble, but because of the size of the casting, we could not use the common practice of putting the work across the table when we had finished the lengthwise grooves. The normal thing to have done would be to reset the casting, fix an extension on the planer head, and machine the work, resetting after doing the first groove. This would have meant about three hours of setup for each groove, so we decided on a different approach.

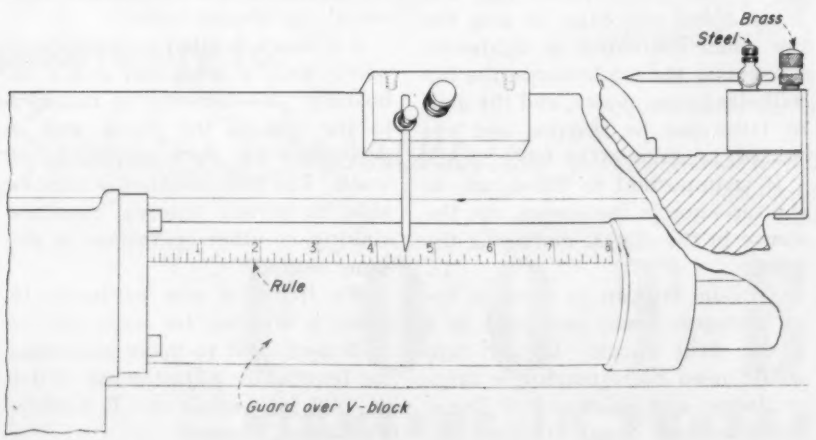
We removed the crossfeed handle from the machine, and fixed, in its place, a V-pulley. We then chucked a 2-in. steel rod in a pipe threader and fastened another V-pulley on this rod. The threader was positioned so a V-belt in the threader pulley could drive the pulley on the crossfeed of the planer. By turning the driving belt of the planer by hand, we could position the tool, and, when in place, the pipe threader was started, moving the tool across the work. At the end of the stroke, the pipe threader reversing switch was tripped, and the tool was brought back to the beginning of the groove.

This setup saved us about 3 hours of setting up for each of the transverse grooves. *Walter Berry, Cornwall, Ontario, Canada*

Remove Steel Splinters

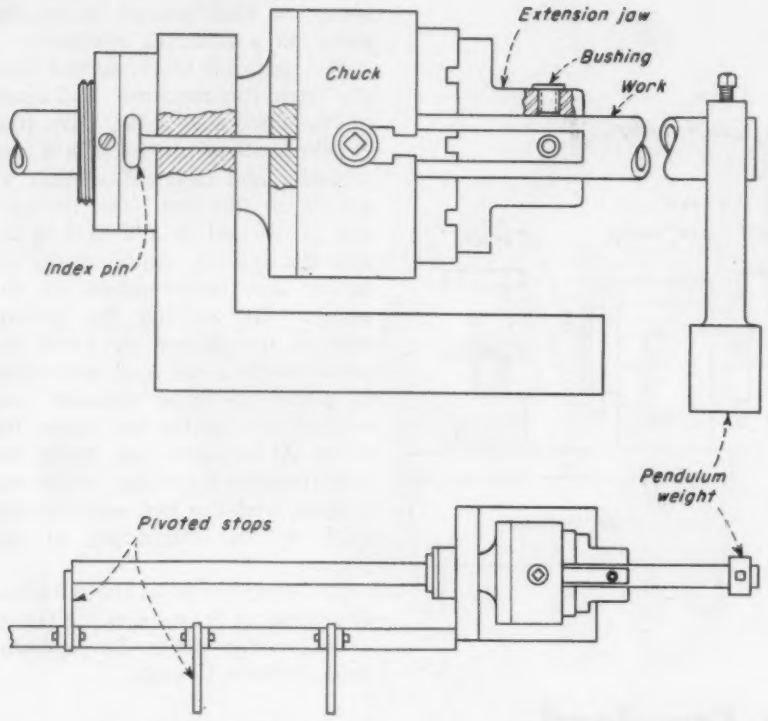
We read with interest the clever idea of Mr Sperman, (*AM*—June 6, '55, p168) in which he tells of removing metal splinters with an emery cloth. We have used the magnetic chuck of our surface grinder for the same purpose by simply touching the steel splinter to the energized chuck. *H J Gerber, Stillwater, Okla*

Scale For Small Lathe



The attachment shown here was made for use on a light turret lathe which had no provision for measuring depth of shoulders and recesses. The pointer block can be slipped on and off in very little time, and replaces chalking or otherwise marking the work.

Except for the pointer, which is made of Stubb's metal, and the brass setscrew, the device is made of mild steel. The rule is soft-soldered to the guard, and the pointer slides along on the lathe shear. A thumbscrew provides for adjusting the pointer to the diameter of the work. *R Johnston, Glasgow, Scotland*



Pipe Drill Jig

The jig shown here was used to drill ten-foot lengths of pipe with a group of 4 holes spaced 90° around the periphery, with each group of holes 24 in. apart.

The jig and gaging device were built from scrap and odd parts lying around the shop.

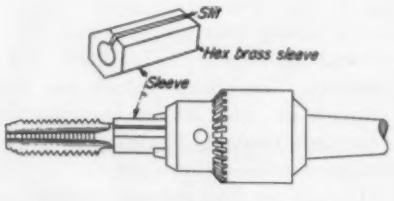
A 4-jaw independent chuck with removable soft jaw inserts was mounted on a standard cast iron angle plate. The back plate to the chuck and the angle plate were line-drilled and reamed for an index pin. Another hole was drilled in the back plate at 90° from the first hole, but also in line with the index pin hole.

A special set of soft steel jaw inserts with extended lip was installed in the permanent chuck jaws. Into two adjacent jaws proper-sized drill bushings were inserted.

A heavy pendulum weight fastened to the outer end of the pipe keeps the pipe radially located when the chuck jaws are released to move the work.

A welded angle-iron stop rail carried pivoted stop bars to position the end of the pipe for each group of holes.

Unless great accuracy is desired, it is only necessary to drill through two adjacent bushings, and run the drill completely through the pipe. If more accuracy is needed, four bushings can be used—one in each jaw. *H J Gerber, Stillwater, Okla*

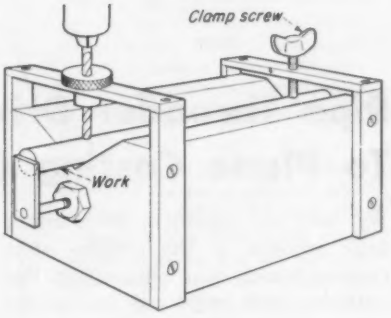


Attachment Avoids Broken Tap

Breakage of taps is almost entirely avoided with this simple attachment, which is easy to make and use. The device is a standard drill chuck with a sleeve made from hexagon brass, to give a friction drive. The hexagon stock is drilled out to take the required tap, and is slit along one edge, to grip the tap when the chuck is tightened. As soon as the tap bottoms, the tap will slip in the sleeve, and the drill or lathe can be stopped and reversed, to remove the tool.

It is important to use brass, so the tap slips in the sleeve, not the sleeve in the chuck, damaging the jaws.

A ½-in. tap can be fitted in ½-in. hexagon brass, and used in a ½-in. drill chuck. Larger taps would need correspondingly larger sleeves and chucks. *P V Dunn, Johannesburg, South Africa*

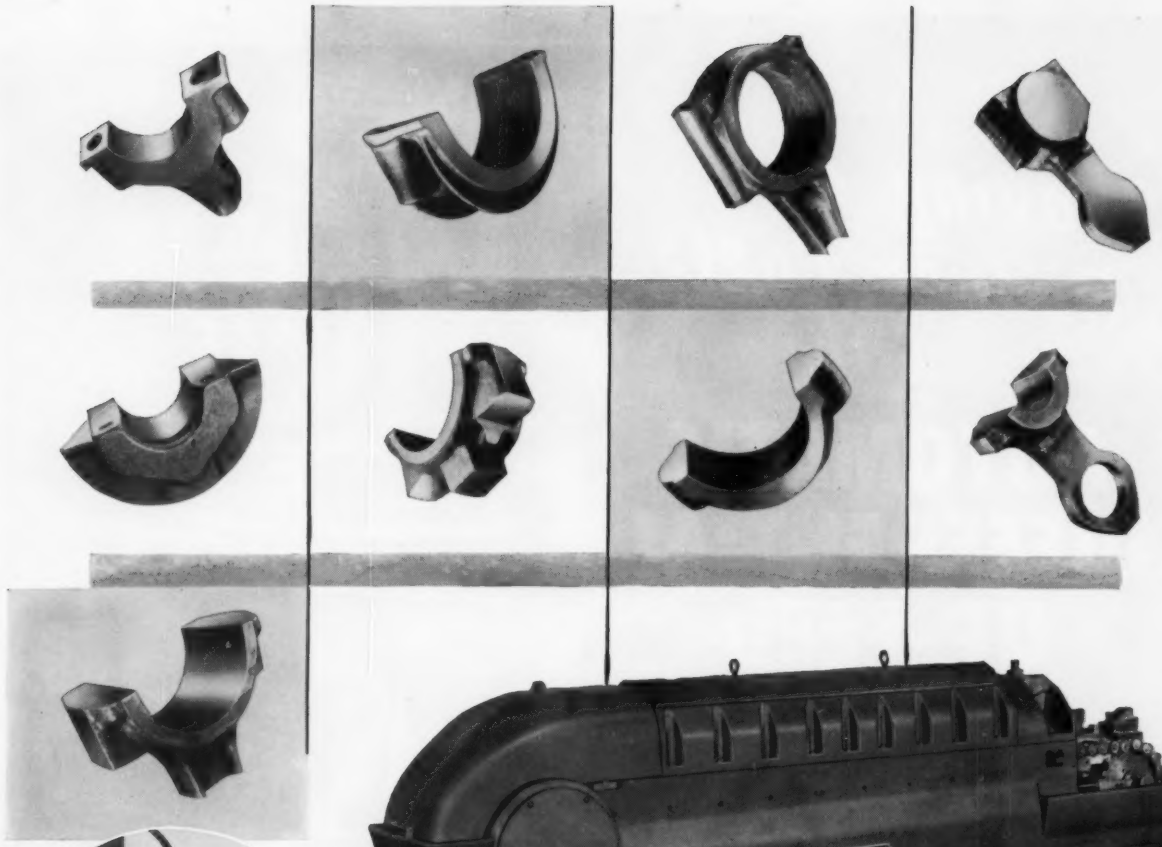


Universal Jig For Round Bars

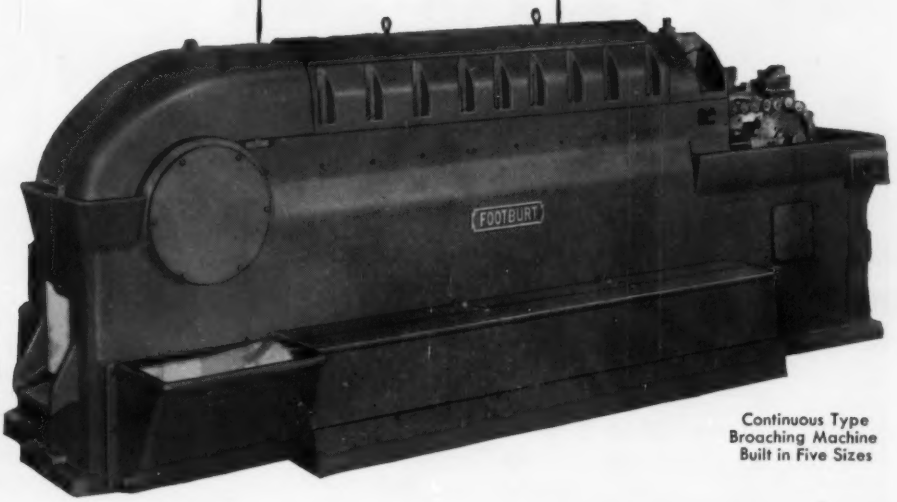
We had several small batches of rods of varying diameter, which were to be drilled near the ends of the work. The small lot sizes did not justify the cost of separate jigs for each size, so we made the universal jig shown here.

A V-block is fitted with brackets which hold a wing-nut and drill bushing. An end-stop is fastened to the end of the block, and is adjustable for varying lengths of work. The drill bushing is removable, to permit tapping, countersinking, or other operations in the same setup.

We found it was advisable to make a bushing for each size of drill used, and to make end-stops for lengthwise adjustments of 0-1 in., 1-2 in., and so on. *K Gelder, Yorkshire, England*



Holding Fixtures are designed for quick, convenient loading, with automatic clamping, unclamping and unloading.



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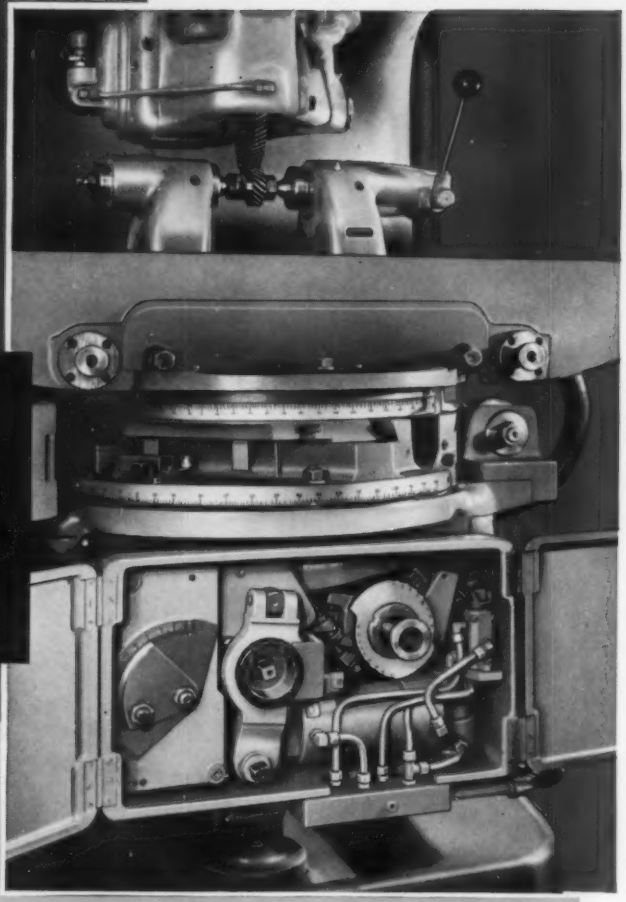

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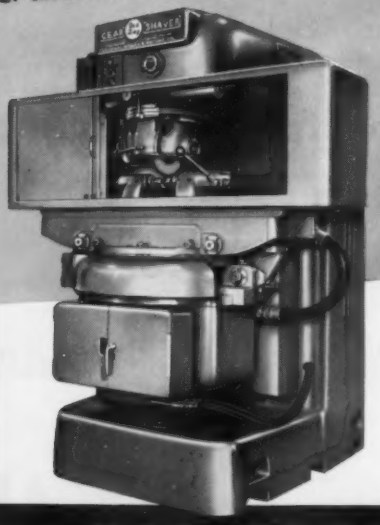

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PROPELLER-AGITATED QUENCHING...VII

Source: "Improved Quenching of Steel by Propeller Agitation," published by United States Steel Corp, and abstracted by permission.

GENERAL RULES FOR AGITATOR USE

Seven general rules apply to engineering a propeller - agitated quenching setup. The first two rules were published earlier (*AM* —July 18, 1955, p157)

3. Positioning

(a) Top Entering (Portable) Units

The shaft enters the bath at an angle of about 16° from the vertical and is long enough so that the propeller is one propeller diameter distance from the bottom. In such units the level of the quenchant should be at least two propeller diameters above the propeller to prevent undesirable vortexing and sucking of air.

In conveyorized units, the propellers have been installed in front of the chute, the distance from the chute being in the range of 2½ to 4 propeller diameters, depending on the mass and shape of the part to be quenched. This has helped to prevent parts being thrown from the conveyor.

(b) Side Entering Units

The length of the propeller shaft inside the tank generally has been not less than one propeller diameter. A vertical distance between the shaft and the bottom of the tank of one propeller diameter plus 6 in. is considered satisfactory. The bottom of the quench load and the shaft are usually separated by a space equal to one propeller diameter.

Vortexing can be minimized if a vertical distance of twice the propeller diameter or more, from the top of the propeller blade to the surface of the quenchant, is provided.

In cylindrical quench tanks requiring more than one unit, the location will depend on the height of the tank. Short tanks requiring two units at the same horizontal plane may be installed as shown in Figs 14 and 18. When three units are used, they have been spaced 120° apart with each shaft entering the tank at an angle of 7° with a radius line as indicated in Fig 14, or the units may be installed 45° apart with each shaft entering the tank at an angle of 7° with a radius line. Tall tanks require units mounted at different horizontal planes for uniform quenching.

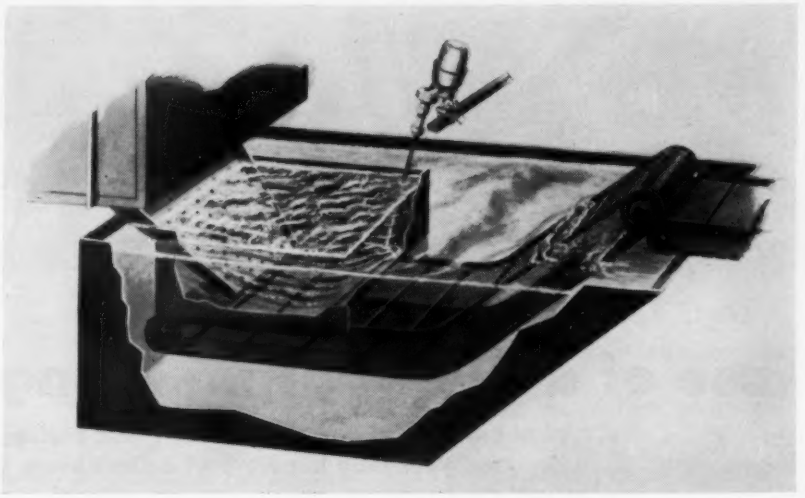


FIG. 16

4. Corners

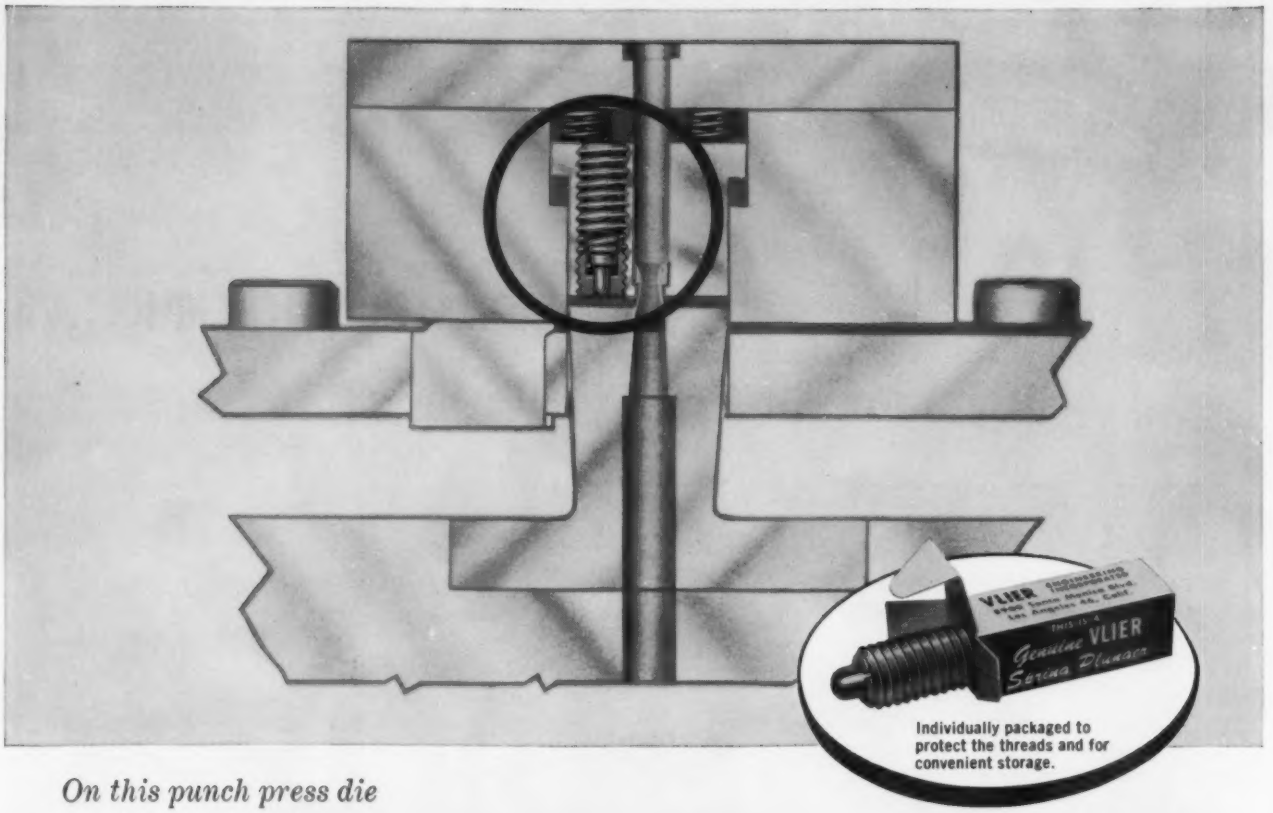
Corners in most tanks may be rounded off by filleting. These fillets may be of relatively light gage metal and may be tack-welded into position, because they do not need to be liquid tight. Such filleting helps promote free motion of the quenchant.

5. Timing of the Quench

Each part quenched should remain in the quenchant a specific length of time, depending on the dimensions of the part and the type of steel. With the exception of alloys in which retained austenite is a problem, it is desirable to remove parts when the surface temperature is 250 to 500 F (depending on the amount of martensite desired) and then to temper immediately. Benefits include reduction or elimination of warpage and cracking, shortening of the heat-treating cycle, and conservation of heat.

6. Make-Up Water or Oil

When fresh water or oil or cooled water or oil is introduced into the bath while parts are being quenched, the fresh quenchant should be introduced equally into all propeller streams from the shaft side of the propeller so that optimum uniformity of quenching temperature may prevail. However, if make-up liquid is added between quench loads, it can be introduced in any location. Then by allowing the propellers to rotate for two or three minutes the whole bath could



Individually packaged to protect the threads and for convenient storage.

On this punch press die

use of a Vlier Spring Plunger saves $67.00

A typical example of how Vlier ready-made tooling accessories can save your shop hundreds of dollars every year

Formerly a "homemade" plunger device was used to break oil seals and eject parts from the punch press die shown above. Cost of resurfacing the die was unreasonably high because of time required to remove and re-install the complicated plunger device. Replacing the "homemade" assembly with a Vlier *Silvernose* Spring Plunger eliminated this lost time and, according to company tool engineers, saves $67.00 each time the die is resharpened.

As simple and quick to use as a screw

Installation and removal of Vlier Spring Plungers requires only a simple spanner-type wrench for standard nose models and an ordinary end wrench for the Hexnose type. Since only a tapped hole is required in the die, the plunger can be installed almost anywhere on the die surface. Bodies are threaded with N.C. threads, #1 fit, and rust-proofed to prevent freezing in the fixture.

Precision made

Close tolerances and large bearing surfaces between the plunger nose and the body prevent the nose from binding or wobbling, assuring perfect alignment at any extension. The nose telescopes completely within the body.

Special springs for punch press work

Springs used in *Silvernose* models were especially developed for fast, repetitive operations required in punch press work. End pressures are factory-set with the nose telescoped 50%, and are guaranteed to remain constant.

Case-hardened nose assures long life

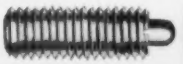
Case-hardening of the plunger nose provides maximum resistance to wear. The ductile core minimizes the hazard of fracturing under impact, common with hardened, high carbon steel.

A variety of uses

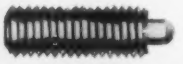
Vlier Spring Plungers are also used to position parts in jigs and fixtures, as locating pins, as detents, etc. Your Vlier distributor stocks the complete line. Call him now and order a complete assortment. They save tool maker's time and speed fabrication of jigs, fixtures and dies.

Four Nose Types Available

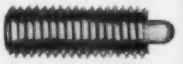
Wide variety of diameters and lengths.



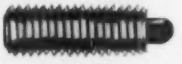
STANDARD NOSE
Primarily for jig and fixture use.



SILVERNOSE
Light end pressures for punch press operations.



PLASTIC NOSE
For use with aluminum and brass.



HEXNOSE
Adjusts easily with an ordinary end wrench

Write for your free copy of the new 1955 Vlier Catalog

Other Vlier tooling accessories

TORQUE THUMB SCREWS | SWIVEL-PAD CLAMPS | TOGGLE PADS | SPRING STOPS | FIXTURE KEYS

VLIER ENGINEERING INCORPORATED

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PROPELLER-AGITATED QUENCHING... VIII

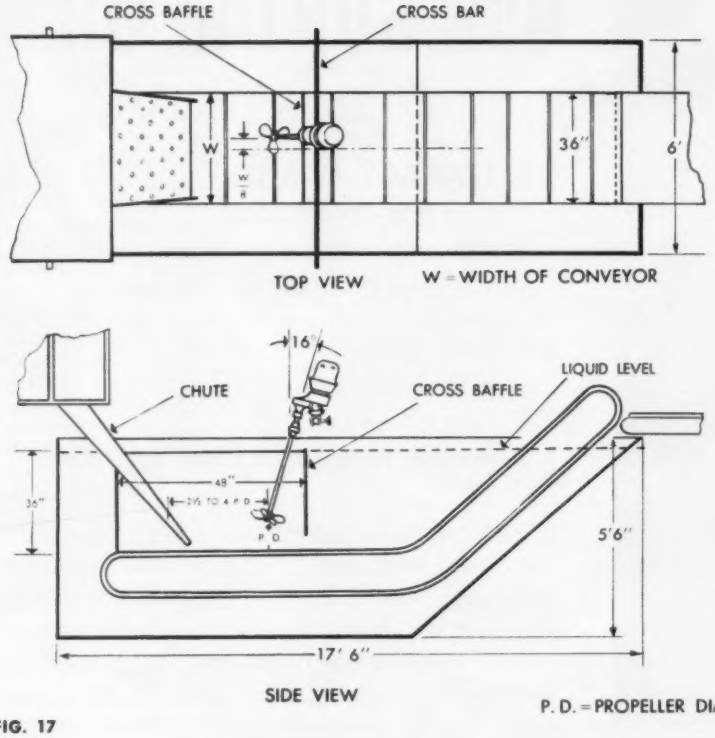

FIG. 17

be quickly brought to uniform temperature.

7. Scale in a Bath

It is necessary to remove scale periodically from most baths. However, it is a good practice to allow some scale to remain in propeller-agitated baths, because some of the scale is held in suspension and impinges on the part being quenched, thus hastening the breakdown of the vapor film. Cooling coils are kept clean by this same action.

DESIGN OF INSTALLATIONS

Two examples will be discussed: a rectangular quench tank with conveyor (Fig 17) and a round tank (Fig. 18).

Perforated baffles are installed in the rectangular tank to confine propeller agitation to a quenching zone measuring about 36 x 36 x 48 in., or 270 gal. Oil flows through the perforations into the main tank area and is led off to the cooling unit. Size and number of top-entering propeller units are calculated as follows:

For oil—power required to agitate 270 gal. of oil (Table 2) equals 270 x 0.005=1.35 hp. Nearest size of propeller unit (from Table 3) is 1 1/2 hp. with 14 in. dia propeller.

For water — power required equals 270 x 0.004=1.08 hp. A 1-hp unit with 13 in. dia propeller should be used.

The unit is mounted on a crossbar with the propeller from 2 1/2 to 4 propeller diameters away from the chute and one diameter away from the conveyor. The shaft enters the bath at 16° from the vertical and is off center about one-eighth the total distance between the side baffles. If two units had to be used, they would be offset with respect to the centerline of their respective halves of the tank quenching zone by 1/16th of the total width.

The round tank (Fig. 18), is 9 ft. dia and contains oil 10 ft deep, or 4800 gal, to serve a shop that handles a wide variety of work—shafts, gears, rings, basket work, die blocks. Calculations of power and size of units yields two units of 20 hp and 26 in. propellers. The shafts enter the tank at opposite quadrants and at a distance of one-half the radius from center. A 15 in. baffle plate opposite each propeller takes its thrust, and extends from the tank bottom to the load-support gridwork.

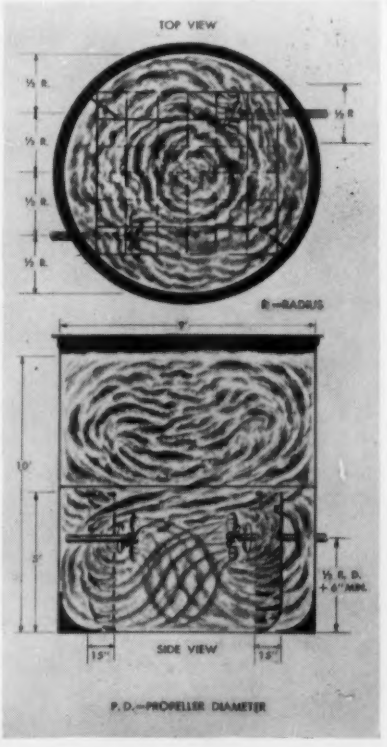

FIG. 18

Wherever throw-off, drip or squeeze-out is a problem...

USE SUNTAC OIL

OIL LEAKAGE MEANS:
higher lubrication costs
messy machines
hazardous oil slicks on the floor

SUNTAC OIL:
cuts leakage
lowers oil costs
minimizes hazardous floor conditions

In addition to its leak reducing properties, Suntac has all the high quality of expensive general-purpose oils. Suntac is fortified against oxidation to assure long oil life and against rust and corrosion to protect valuable machines. And, last but not least, because the leak-reducing agent is 100% petroleum, Suntac leaves no gummy film or residue.

For more information about Suntac, the oil especially made to prevent drip, throw-off and squeeze-out, see your Sun representative or write for your copy of Suntac Technical Bulletin to Sun Oil Company, Philadelphia 3, Pa. AM-8.

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SAFETY REGULATIONS FOR CONVEYORS

Source: Proposed revision of "Safety Code for Conveyors, Cableways and Related Equipment" to be published by the American Society of Mechanical Engineers

DESIGN FEATURES

The following general safety regulations apply to every type or form of conveyor. They apply to horizontal, inclined, declined or vertical conveyors; they apply to conveyors supported from floors, hung from ceilings or structures, supported in bridges or trusses; and they apply to conveyors operated manually, by gravity or by power.

Safety guards shall be provided on all types of equipment at driving mechanisms, terminals and take-ups where the unguarded parts may constitute a hazard to the operating personnel.

Rated capacity shall mean the capacity as established by the designer of the equipment.

Belts, Chains, Cables. In no case shall the maximum loading exceed the working load as recommended by the manufacturer.

Pulleys, Sprockets, Sheaves, Drums, Blocks. All of these, when located in a working area where operators (other than maintenance men) are present, shall be arranged to prevent the possibility of injury from hands or parts of clothing being caught between the belt and pulley, or chain and sprocket, or cable and sheave, drum or block. When these units are located in areas where authorized personnel only have access, then such arrangements of frames or guards will not be required if provisions are made to stop and lock out the power before work is performed on the conveyor. If cable tension varies considerably, or is subject to whipping action, all sheaves should be provided with suitable cable guards to prevent the cable from jumping the sheave.

Bearings (Lubrication). Where bearings are inaccessible or in hazardous locations, the fittings should be located at an accessible point and the lubricant piped to bearings.

Adjustments. Means provided for changing the position of pulleys, sprockets, or sheaves, to compensate for normal working stretch and wear in endless belts, chains, or cables, shall be readily accessible, and guards shall be provided to protect maintenance personnel from contact with the moving parts if adjustment is required when equipment is in operation.

Backstops and Brakes. (*a*) On all conveyors where reversing, or running away, presents a hazard, "anti-runaway" or "backstop" devices should be provided; or the track of the conveyor designed to prevent any portion of the conveyor and load from falling or sliding down in the event of mechanical or electrical failure. When such design is not practical, suitable guards (designed to withstand the shock and confine the falling load) shall be placed to prevent access to the danger area.

(*b*) Electric machines equipped with brakes which are mechanically released and applied by the movement of operating devices shall be so designed that if the power is interrupted with the brakes in the off position, the load can descend only at a controlled speed. Electrically released brakes shall not be released until the power has been applied to the motor and shall be applied automatically if the power fails or the operating device is returned to the off or stopped position.

Overload Protection. In addition to overload protection customarily provided to protect electric motors, there should be an overload device to protect the conveyor and mechanical drive parts. Such devices must be designed to shut off the electric power quickly or disconnect the conveyor or drive parts from the motive power in the event of overload.

Where overload conditions would create a hazard to personnel, overload protection shall be provided. Such overload devices can be of any type arranged to shut off electric power; can be shear pins; can be slip or fluid couplings; or any other type designed for the purpose of quickly disconnecting the motive power or limiting the applied torque. If a shear pin device is used, a description of the proper size and material of the shear pin should be placed at such a point on the conveyor that the operators can readily see it when replacement is being made. Where the failure of the overload device would permit overspeeding in either direction, with consequent hazard to personnel, a centrifugal control device shall be used in addition to the other safety devices previously specified.

Hinged Sections. (*a*) Manually operated hinged sections of gravity roller conveyors, chutes, belt, or other types of conveyors that require more than a minimum effort to operate should be counterbalanced. (*b*) Power-operated sections should be provided with mechanical safety devices which will prevent them from falling in case of power failure. Protection against the failure of mechanical parts of the hoisting and lowering device should be provided when practical.

(*c*) All hinged sections of power conveyors used for the purpose of clearing a passageway shall be designed so that they cannot be raised while the conveyor is in operation, shall stop the conveyor automatically when the section is raised.

Counterweights. When counterweights are attached to cables or chains, the weights shall be confined in a suitable inclosure having a stop designed to withstand the impact of the falling weight. If counterweights are attached to lever arms, the design shall insure that the weights cannot become detached if the device used for the adjusting of the weight becomes loose.

Guards. (*a*) Where a conveyor passes over working areas, aisles, or thoroughfares used by other than authorized personnel, suitable guards shall be provided to protect those areas from the hazards of dislodged materials.

(*b*) Where conveyors are installed overhead and dip down at work stations, suitable guards or handrails shall be provided to prevent accidental injury to personnel.

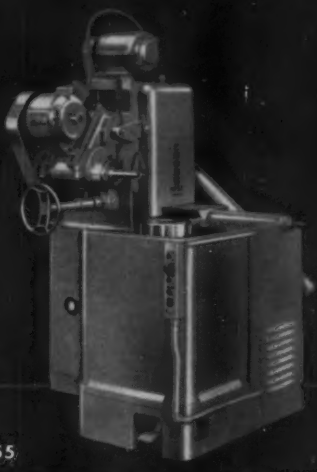
(*c*) Guards should be painted in colors specified in ASA A53.1-1953.

Interlocking Devices. On all conveyor systems where practical, electrical and/or mechanical devices should be provided to stop a conveyor automatically when the conveyor, bin, hopper, chute, etc, to which it feeds, has been stopped or has been blocked with loads so that it cannot receive additional loads or material.

Transfer, Loading and Discharge Points. At conveyor transfer, loading or discharge points, means shall be provided to guard against accidental injury to personnel at such locations.

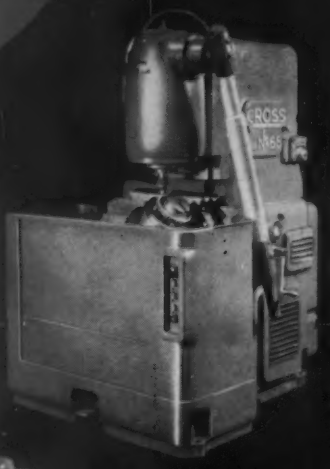
for rounding • chamfering • pointing • burring

Greater Flexibility with Cross Gear Machines



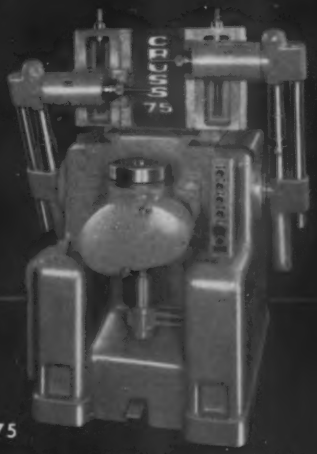
NO. 55

For rounding, pointing, chamfering or burring external and internal—
spur gears • helical gears
clutches • splines
Typical production—rounding or pointing 8 pitch 30 tooth gears—55 net hourly.



NO. 65

For pointing or chamfering external and internal—
clutches • spur gears
bevel gears • splines
Typical production—pointing 10 pitch 30 tooth gears—100 net hourly.



NO. 75

For burring or chamfering both ends at the same time—
helical gears • spiral bevel pinions
hypoid pinions
Typical production—chamfering 8 pitch 40 tooth gears—200 net hourly.

- ★ **Flexibility for handling a wide variety of gears.**
- ★ **Rugged, heavy duty construction for continuous high production or job shop operation.**
- ★ **Short setup time (as little as 15 minutes) for changing from one gear to another.**
- ★ **Simple, inexpensive tooling.**
- ★ **Push button controlled automatic cycle.**
- ★ **Hydraulic power work clamping.**

For mass production or short run jobbing operations, there is a Cross Gear Machine to suit your requirements.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Talking Shop . . .

Lab Trouble

INCREASES in quality-control and pilot research work have tremendously amplified industrial lab activity. But intensification has brought a much greater increase in accident frequency, according to J O Bengston, president, Chicago Apparatus Company. Accidents indicate lack of cooperation with company safety directors, wrong mental attitude, and failure to use safety types of apparatus and equipment.

Bow Test

TO TEST critical jet components, such as blades of an inducer wheel in the impeller assembly, Ray Schlesier of Fairchild Engine Div uses a 'cello bow. He has never played an instrument, but he is a stress analyst, and knows that you can determine natural frequency of a bow. It is essential that the natural frequency of a blade be different from that of exciting forces (such as aerodynamic disturbances) in the engine. Therefore, he draws the bow over each blade, or other part, in turn, setting up a "squeal" which is picked up by a microphone. The sound is relayed to a Strobocom Frequency Indicator, which identifies it as a musical note and indicates its frequency. If this frequency is that of one of the exciting forces, it must be changed.

If Mr Schlesier had a true musical ear, he'd need only the mike and headphones—he'd be his own Indicator. That's how stress tests in bridge models have been made for years.

Expert

ACCORDING to George W Papen of Lockheed Aircraft, "expert" is derived from the Greek, the "X" of course being an unknown quantity, and the "spurt" being a drip under pressure.

Mr Hack's Saw

EVER WONDER where the hacksaw got its name? Well, Warren Ogden, Jr, an authority on antique machines and tools, did and here's his theory:

"I can't prove it," he says, "but in Gill's 'Technological and Microscopic Respository', by Thomas Gill, London, circa 1830, in one of the volumes, I came across a Thomas Hack who invented a saw to cut down trees, among other things, and I can imagine it was called Mr Hack's saw for a while—try saying that one! What do you get—hack-saw!

"Mr Hack was also mentioned in Brewster's Edinburgh Encyclopedia under "Saws" and received a silver medal from the Society of Arts in 1820 for the invention of a four-jaw self-centering chuck. Quite a boy!"

Air Statistics

CONSTRUCTION of just one big bomber requires more than 165,000 tools in its some 184,000 parts. And it takes 8,954 parts and 87 different specialists to build one of the engines which power some of the newer military aircraft.

Executive Salaries

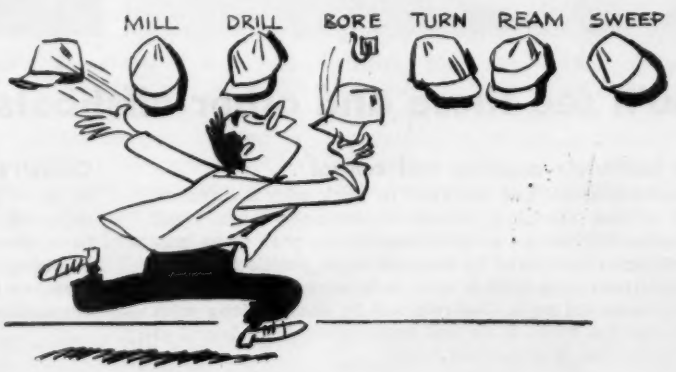
TIME MAGAZINE recently reported, on the basis of 22,000 returns from mailed questionnaires to 55,000 industrial executives, that average family income is $10,128 a year. Some 67% of the men placed their income between $5000 and $9999. While 49% of respondents reported incomes above $7500, there were 5% with incomes of $3000 to $4999, and 42% with incomes of $5000 to $7499. Of the top 49%, there were 25% (roughly half) with incomes of $7500 to $9999, another 15% at $10,000 to $14,999. A total of 5% reported income of $15,000 to $24,999, and only 4% were at $25,000 or above. Better than 80% had gone to college, and 57% had been graduated. Ages were: 41% under 35; 28% are 35 to 44; another 25% are 45 to 59; and only 6% are 60 or over.

Shapes to Come

NUMERICAL CONTROL will accelerate the trend away from point-to-point measurement. The die-hards who stick with the old system will have to limit it to handmade pieces, because NC works from a base and avoids cumulative errors resulting from accumulated one-sided tolerances . . . Another potential for this system is to compensate for table or machine distortion from heavy pieces or from service or other heat expansion. By applying strain gages in combination with electronic control equipment as part of NC, builders can produce machines that measure and compensate for distortion. It will add to cost, but on precise parts, scrap saving pays for it.

Guaranteed Annual Work?

PRESSURE for GAW will undoubtedly spread throughout Metalworking, so it is advisable to consider some of its implications. One is the likelihood that less subcontracting will be done, less work assigned to other departments. The overload will be put aside, to be handled when men are available. And, most of all, the trend from all-round man to specialist may be reversed. Now, the pressure will be to have men who can do any job, so can be kept busy on anything that needs to be done when work is slack. This reminds us of a time back in 1921 or '22, when work was slack. The men who kept their jobs were the all-round ones and the inexpensive ones. The costly specialists—and the high-powered foremen—were first to go.



PRODUCTION ENGINEERING SHOW:

"A great institution in its own right" is the slogan of the forthcoming Production Engineering Show, which, while it will complement and run concurrently with the Machine Tool Show, will stand on its own feet this year and every year from here on out as the showcase for new automated production and processing methods

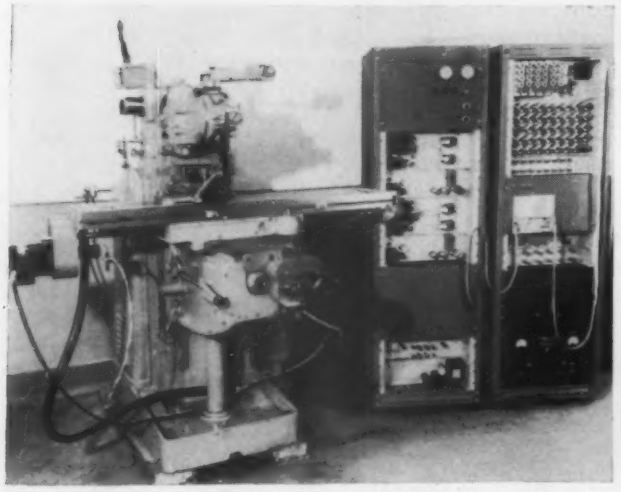
CHICAGO—Visitors to Metalworking's great once-in-every-seven-years-or-so Machine Tool Show coming up September 6-16 in Chicago, will get a look at the first, giant industry-wide "Automation Exposition"—the Production Engineering Show—to be held at Chicago's Navy Pier concurrently with the Machine Tool Show.

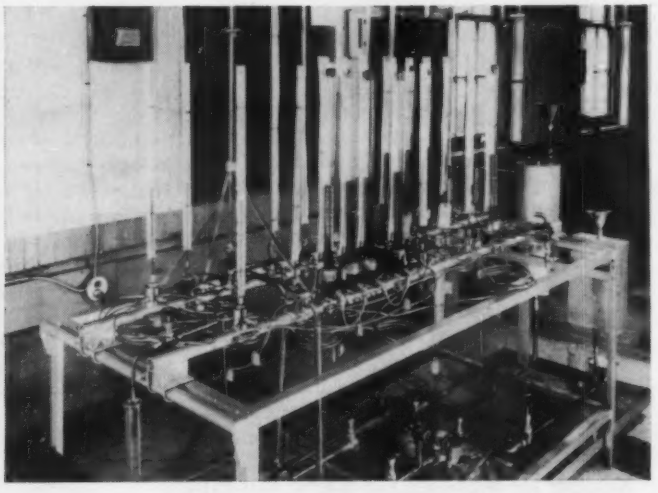
The PE Show, while it will complement the Machine Tool Show by showing automated Metalworking production processes and techniques, cuts a broad swath across all types of manufacturing and processing to take in "any production process in which the sound application of engineering techniques and control equipment can measurably contribute to automatic production of the plant." It is the first of a series of annual shows.

PE Show exhibits will consist of mechanisms, instruments and equipment for automatic production. No special, single-industry equipment, or exhibits of machine tool builders and dealers will be shown. In this way, PE Show exhibitors will become major participants in a companion medium to the Machine Tool Show, rather than fringe exhibitors with a subordinate role. Clapp & Poliak Inc, managers of the Machine Tool Show, are presenting the Production Engineering Show by agreement with the National Machine Tool Builders' Association, sponsors of the Machine Tool Show. Thus, corollary equipment for the automation of machine tools will be shown to its fullest advantage, leaving the International Amphitheater, expanded but already filled to capacity, to the exclusive showing of machine tools.

Direct bus service will be maintained between the Machine Tool Show at the International Amphitheater and Navy Pier.

. . . where *American Machinist* will exhibit automation





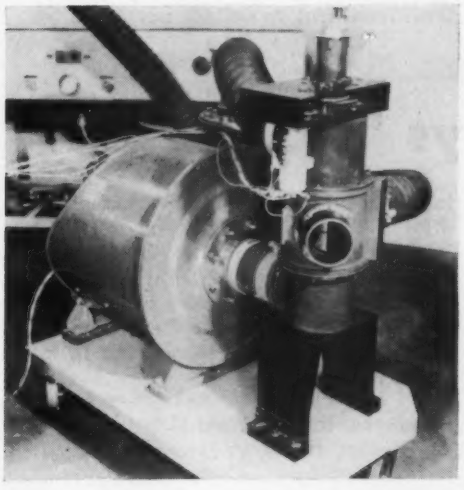
You'll see these and other offshoots of college research at

Case Institute's machine tool control . . .
is two-dimensional and designed to work with a standard No. 2 milling machine. Numerical controls, taken from original specifications or drawings of the part to be machined, and transferred to punched tape, position the lateral and transverse table screws to traverse the work over a predetermined path. Controls will be shown along with a combination work table and explanatory back board at the Production Engineering Show

Cornell's fluid analog . . .
to be in the American Machinist exhibit at the Show, is designed to analyze complex heat flow problems. It has been used successfully as a visual teaching aid for representation of complex thermal systems, and as a handy research tool for analyzing all types of heat flow problems encountered in industry

Navy Pier Will Be Automation's Showcase

research work of eight universities



AM's exhibit . . .

MIT'S air valve and blower . . . was developed by the Institute's Servomechanism Laboratories. Rotary valve's angular velocity is controlled by a 5-watt servomotor in response to pressure error signals. MIT will also exhibit an automatic iron lung control that regulates oxygen flow from data taken automatically from the patient

UNIQUE DISPLAY WILL PREVIEW AUTOMATED PRODUCTION TECHNIQUES OF THE FUTURE

CHICAGO—A preview of what today's pure and applied research has in store for industry will be a feature of the Production Engineering Show, to be held at Navy Pier here concurrently with the Machine Tool Show, September 6-16. The giant exhibit, co-sponsored by *American Machinist* and two other McGraw-Hill publications, *Product Engineering* and *Control Engineering*, and Clapp & Poliak Inc, managers of the show, will show the results of college research into automated production techniques. The work of eight universities will be shown: Case Institute of Technology, Cornell, Illinois Institute of Technology, University of Illinois, MIT, University of Michigan, Northwestern, and Ohio State. The exhibit, the most comprehensive of its kind ever attempted, will have these displays to interest Metalworking:

- The first operating scale model of a nuclear reactor will be shown to the public for the first time.
- A metal cutting technique that measures temperature between tool and work surface during cutting.
- A punched-tape control for milling machines.
- A "random programmer" that insures a statistical sampling of products from production lines.
- Machine that mills titanium and keeps a record of the surfaces produced during the operation.
- Vertical broach that measures cutting forces and records tool wear.
- Vertical band saw that measures cutting force and infeeding force while blade is in operation.
- Engine lathe equipped with a 3-component force dynamometer that measures cutting forces, and measures tool wear as a function of cutting time.
- Special lathe with 10,000 rpm spindle speed and tangential-force strain-gage dynamometer to measure tangential cutting force of aluminum and seven of its alloys in terms of hp per cu in per min.

WHY MERGE? No "Liquid Working Capital"

DETROIT—When a smallish Metalworking firm gets caught in a squeeze between fast growth and lack of working capital, the easiest way out is to become part of a larger company, and let the bigger firm solve financial difficulties through public financing. That's the consensus of 19 middle-sized Michigan machinery makers, expressed in response to a survey on the whys and wherefores of the mreger wave.

The surveying firm, Prudential Acceptance Co, Detroit division of James Talcott Inc, industrial financiers, questioned 19 makers of non-electrical machinery — engines, turbines, diesels, agricultural equipment, tractors, machine tools, metalworking machinery, and special machinery. This is what the survey came up with:

Growth of Michigan's non-electrical machinery industry in recent years has been phenomenal, yet medium-sized firms find they are too small to get capital through public financing, but too big to satisfy all their requirements through bank loans. Thus, faced with a shortage of working capital to carry out expansion plans, more and more small metalworking firms are selling out to bigger companies who can obtain necessary financing for expansion.

"Not Always Good"

And this, in the opinion of the surveyed companies, isn't always a good thing: "Merger of smaller and giant machinery manufacturing companies sometimes means a loss to the Michigan economy. It is the small and medium-sized companies which usually take a basic development after it has become a potentially marketable item—then market it.

"They are the companies which work with other small and medium-sized manufacturers and tailor their products for the other smaller companies. Often they will grow together. By being merged, these smaller companies serve as a captive Michigan outlet for a larger out-of-state economy — but they usually lose their growth in the process of becoming a mere arm of an out-of-state giant."

Lack of small-firm capital in machinery manufacturing is particularly evident, according to the survey, which estimates these companies must invest $15-20,000 per worker in capital equipment—and three to four times that amount in highly mechanized plants. National average investment per worker in industry generally is around $12,000.

Michigan's machine tool builders and nonelectrical equipment manufacturers have been doing well recently. Last year they upped their sales 20%, although the industry nationwide was off about 25% from 1953. Add to this the rapid rise in Michigan wages, and you have a powerful incentive for mechanization. A noteworthy trend among Michigan machinery-making firms this year has been substitution of new equipment for new plants.

Squeeze on Bank Credit

This means the machinery maker needs bank credit or stock sales to expand facilities, meet heavier payrolls, buy raw materials, and to cope with higher operating costs before the investment amortizes itself and

FAST WRITEOFFS? Treasury Says "No," ODM

Top-level Washington hassle is shaping up over fast-tax amortization for defense-related industries. If Treaury's Humphrey gets his way, it's a dead duck. But if ODM's Flemming wins out, fast defense writeoffs will stay on the books

WASHINGTON—The future of accelerated tax amortization for defense-related industries is tied up in a top-level government dispute. Treasury Secretary Humphrey wants fast tax writeoffs stopped. He thinks they're the cause for much loss—really deferment—of tax revenue. Defense Mobilizer Flemming, on the other hand, wants the program continued. In fact, his agency has been considering hikes in some industry expansion goals—notably steel, aluminum, oil refining, and commercial aircraft. And the Office of Defense Mobilization recently lifted the goal for electric utilities.

Here are the pros and cons:

- Treasury thinks last year's tax laws (medium-fast amortization for all industries) cuts the need for extra-special five-year writeoffs for selected industries. Secretary Humphrey prefers lower corporate tax rates to continued accelerated amortization when the next round of tax revisions comes up. Treasury estimates $980 million in tax payments will be deferred under the program in 1955. In all, some $3 billion has been deferred since Korea.
- ODM sees fast writeoffs as the government's least costly incentive for defense plant expansion—figuring it would cost the government $29.4 million to borrow money at 3% in place of the deferred taxes. Yet, if industry earned only 5% on its investment and paid only 50% in taxes, it would take only $1.2 billion of investment to generate $30 million in tax revenues.

Commerce, Interior Want It

On the sidelines, two defense claimant agencies—Commerce Dept, for several manufacturing industries; and Interior, for petroleum—have recommended increased goals and more fast writeoffs.

House Probe Is On

But at the same time, a House Government Operations Subcommittee is probing fast tax writeoffs, which have been under fire before as a "giveaway to business." This subcommittee is first checking into the shortage of railroad freight cars

Is Prime Reason

that's where the small firm is squeezed.

About half of the 19 surveyed companies say they have looked into flotation of small stock or bond issues, and find that the costs are prohibitive—as much as 25% of the total issue. These medium-sized manufacturers say they can't get $100,000 flotations underwritten, and they can't get enough short-term credit from banks.

This lack of credit means the small fellow can't take advantage of commercial discounts, and must deal with suppliers who will carry "slow" accounts. And, of course, he must hold back on sales, production and employment.

The surveyed manufacturers report their greatest need is for term loans. While they can often get repeatedly renewed 60-90 day notes from a local bank, the real need is for 1-5 year loans.

That's why there were 166 mergers among nonelectrical machinery manufacturers between 1948 and 1954—topping all other industries in the recent FTC survey.

Says "Yes

to find out why there's a serious lack of cars now despite the granting of fast amortization to the railroads for purchase of thousands of cars. Fact is, of course, the retirement rate tops new car production volume.

Expansion, Not Modernization

The subcommittee feels that amortization, which is meant for expansion of capacity rather than modernization, has been misused by the railroads. The investigation is likely to spread to all writeoffs.

Decision This Month

The decision on fast amortization's future will be made in August. Right now, the prospect is that five-year writeoffs will be continued as a defense measure, but its scope will be sharply curtailed. Writeoffs granted in past years won't be disallowed now, no matter what happens.

American Machinist's Handbook, New from Cover to Cover, Is Out

Five years in the revision, *American Machinist's* long-standard *Handbook* is here with a new, modern look. Its content is new, too—to keep metalworkers from shop bench to top management abreast of a fast-changing technology, and of what's new in materials and equipment

NEW YORK—Long awaited is the announcement this week of publication of a completely rewritten edition of *American Machinist's Handbook*. Like all handbooks, its predecessor editions had grown progressively more out of date because of reluctance to drop familiar material—and the difficulty of anticipating areas in which additions might be required.

Complete revision was undertaken about five years ago by Rupert LeGrand, now senior associate editor of *AM*. He found need for development of completely new sections, drastic alteration and rearrangement of existing data, and general rewriting to incorporate new ideas coming along at an accelerating rate.

The publisher cooperated by revising format to modern style, increasing the page size to a less-cramped 5¼ x 8 in., redrawing a great percentage of the illustrations—and allowing considerable latitude in last-minute changes to accommodate new developments.

As would be expected, much material is taken from the pages of *American Machinist* and its companion publication, *Product Engineering*. This puts in permanent and condensed form the works of a great number of Metalworking experts from all over the world, as well as the best efforts of our editors. Every opportunity has been taken to make the Handbook useful under present conditions. For instance:

- More than 80% of the Handbook's content has been reorganized and rewritten to keep up with changing Metalworking methods.
- All available information on a particular Metalworking method is to be found in one place. You don't have to refer to several sections of the book for piecemeal data. The section on drilling, for example, includes information on drill selection, standards, drill grinding, coolants, and tells how to drill various materials. You needn't turn to a grinding section to find out how to grind a drill, or to a materials section for data on how to drill a particular material.
- The Handbook is divided into 11 parts, covering 45 sections, with each section having its own contents page. Part 1, Machining Methods, has 13 sections and 614 pages, dealing with every phase of machining from broaching to screw-machine work. Part 2, Metal-Forming Methods, has 142 pages divided into six sections covering spinning, pressworking, forging, die casting, and babbitting. Succeeding parts of the Handbook cover assembly methods, materials, finishing, inspection, fastening devices, tool engineering and drafting practice, machine-tool standards, power-transmission equipment, mathematics and tables.
- The Handbook has its place in the purchasing agent's office—as well as on the bench and in supervisory and engineering offices. Here is one reason why: one section alone lists 900 tool and die steels, their composition, properties, applications; names of suppliers, and heat treating data.
- The Handbook's 1572 pages and more-than-1000 illustrations are (1) the result of painstaking and intensive editorial research combined with the thinking of recognized specialists in the various fields of Metalworking, and (2) a compilation of "how to do it" and technological information published in *American Machinist* and *Product Engineering*.

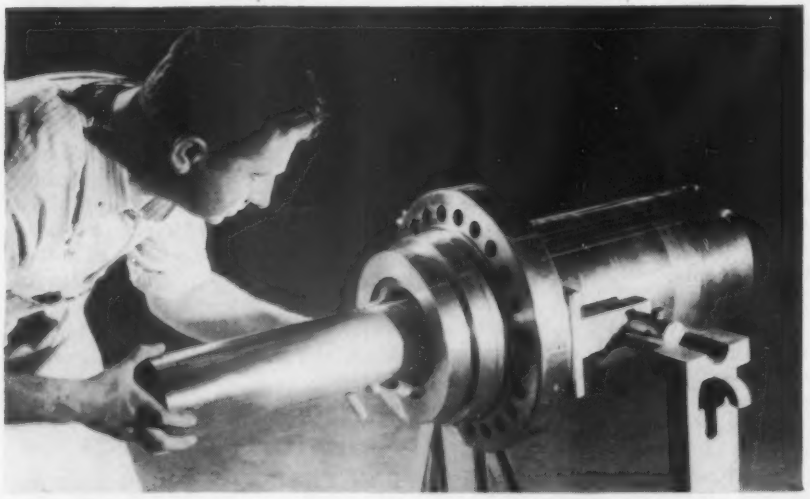
ELECTRONICS SYMPOSIUM SLATED FOR AUGUST 22-23

SAN FRANCISCO—Symposium on Electronics and Automatic Production will be co-sponsored here at the Sheraton-Palace Hotel August 22-23 by Stanford Research Institute and the National Industrial Conference Board. Navy Secretary Charles S Thomas will be the featured speaker, on "Automatic Production and National Defense."

WESTINGHOUSE AT WORK: from

Stamping setups at Westinghouse Columbus . . . range from an 11-die operation for forming a complex washer-top section to a single-die setup for cutting banding straps. Stamped parts include back section of tubs, service and door panels, supports, brackets, and gussets. Flat sheet is inspected for alloy content, tensile strength, hardness, and surface condition before press-room operations are performed. During these operations, in-process inspections are made for size, depth of emboss, width and squareness of flanges, size and location of holes, scratches and surface defects

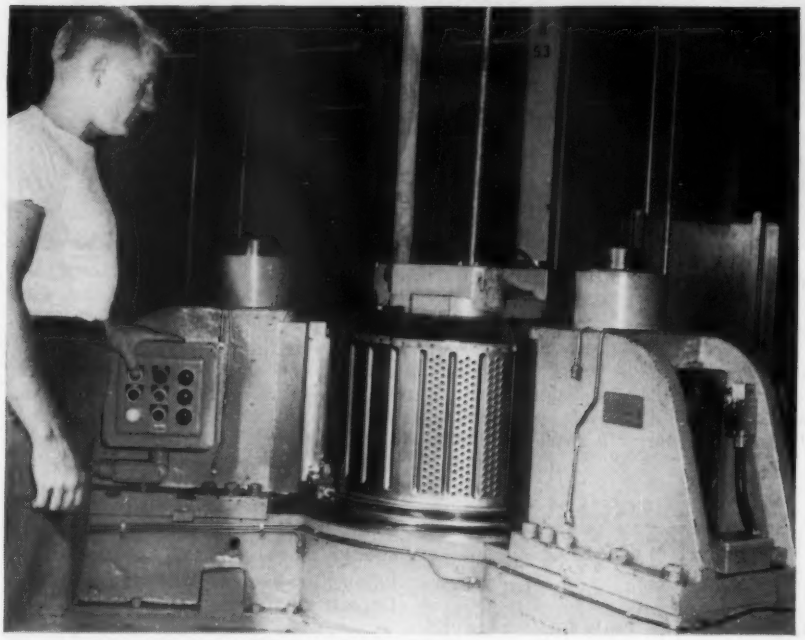
Special concentricity fixture . . . insures that cap opening of each basket is concentric to the mounting axis of the shaft by not more than 3/32 in. Finger on pivoting arm at top of gage indicates eccentricity through a 10 to 1 ratio in lever arms



This is canning . . . Nickel-alloy liner is inserted into stator of motor for pump to handle radioactive liquid circulated through a nuclear power reactor. The liner, or "can" is welded to the stator shell flange and end ring, effectively sealing the radioactive fluid within the pump and motor. The rotor is also canned by shrinking a nickel can over the rotor and welding the ends to protect the rotor and to prevent contamination of the pumped liquid. These pumps are used in the submarine reactor on the *Nautilus* and in stationary power plants, may have other applications in industry

When zero means just that . . . Zero leakage is specified for all canned motor-pumps, and must be maintained to prevent radioactive contamination. Finish boring operation on Type 309 stainless volute (pump housing) is finish bored here after inlet weld has been completed, inspected, and polished

Laundromats to Atoms for Peace



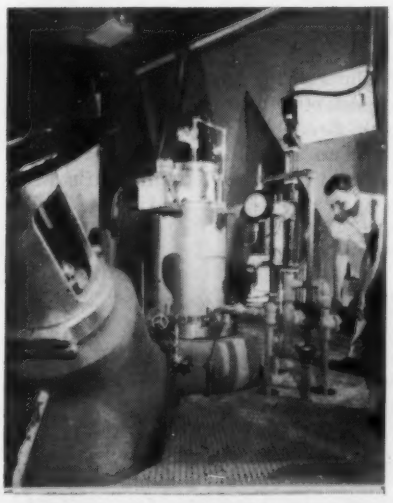
1539 holes in less than a minute . . .
is the job of this hydraulic piercing machine. Indexing table carries a washer basket past three die heads, each of which simultaneously pierces 59 holes in a small vertical panel. Table rotates until each head pierces nine panels to complete the part. When a new part is loaded,table reverses direction to cut indexing time. Work is loaded over a set of three hydraulically actuated punching or piercing stations—on tabs that actuate limit switches to prevent operation of the machine if it's improperly seated

ONE WASHER EVERY 3 MINUTES AT COLUMBUS

COLUMBUS, OHIO—They're turning out a Laundromat every 3 minutes here at Westinghouse Electric Corp's new Appliance Division. And they're keeping up high standards of quality at the same time. How's it done? By combining special-purpose machines with rigid quality control checks all along the line.

Raw material is inspected, delivered to the shear shop, then to the press shop, where various washer parts are blanked, formed, drawn, and otherwise stamped. Some parts are then porcelain-enameled; the others are welded and inspected. All parts go through a unit that automatically washes, rust proofs and etches surfaces for better final-finish adhesion. Outer parts are painted, baked, hand-sanded, spray-coated and re-baked. Sub-assemblies feed into the main conveyor, where final in-process inspection includes a check for grounds at 1100 volts, a wattage check, plus leak tests and operating checks.

Lapping carbon-graphite . . .
Thrust bearing runners are ground and lapped in this special machine to a flatness of 5 to 15 light bands (measured with optical flat and helium-filled tube light reading flatness to 0.0000116 —half the wave length of the light). Weight on carbon-graphite runner in rear is for grinding



Power at Possum Point . . .
First application of a canned motor-pump to circulate boiler feed water in a closed-loop system is this Virginia Electric Power Co unit at the Possum Point generating station. Four larger pumps like this will be required for Duquesne's nuclear power plant near Pittsburgh

CHESWICK TURNS OUT ATOMIC POWER EQUIPMENT

CHESWICK, PA — First privately financed plant to produce parts for atomic power plants is in operation by the Westinghouse atomic equipment department here.

First product of the $3-million investment by this department has been canned motor-pumps (see pictures at left) ranging from fractional sizes to 1400-hp models.

Production of valves for controlling the flow of radioactive fluids is now starting at the plant. Instrumentation, using the new Cypak magnetic amplifiers, is being developed for power stations. The department expects to produce control elements to govern reactivity to round out the line.

W C Miller, manager of the new Westinghouse department, states that the company is looking to the day when it will be able to quote and supply complete nuclear reactors for power generation.

Douglas sculptures one-piece aircraft wing spars on a standard profile miller . . .

at its El Segundo, Calif, plant, where this method saves 50% of cost-per-spar in quantities of 100, and takes only one-fourth of the time needed for assembly work on a detailed constructed spar. Only 18 hrs are required to mill an A4D "Skyhawk" intermediate spar, and 24 hrs for a front spar. Left: man at left regulates coolant flow on the Onsrud profile miller as operator controls movement of the cutter around the contour of the templet. Depth-setting dial selects proper section of depth block, and foot pedals control cutter and stylus movement. Right: 2-in. blank in foreground, compared with the completed wing spar just behind it shows extent of the milling process

Companies in the News . . .

Borg-Warner Corp has acquired **Brooks Equipment & Mfg Co,** Knoxville, Tenn, manufacturers of Load-Lugger hoist bodies, will operate it as a subsidiary.

DeLaval Turbine Pacific Co has moved into its new pump assembly and filter manufacturing plant, warehouse and offices at 201 E Millbrae Ave, Millbrae, Calif.

Ferro Corp's three Chicago-area subsidiaries—**Tuttle & Kift Inc,** electric range cooking element manufacturer; **Ferro Electric Products Inc,** Kirkland, Ill; and **Ferrod Mfg Co,** Batavia, Ill—are being consolidated as divisions of the parent company.

Union Twist Drill Co, Athol, Mass, has taken over operation and direct management of its West Coast operations, formerly under the direction of E B Sutton Co.

Harrisburg Steel Corp, Harrisburg, Pa, has acquired **Precision Castings Co** of that city.

Alex Lewyt, head of three appliance corporations bearing his name, has purchased the six-story **Sperry-Rand building** at 22 Queens St, Long Island City, N Y, now occupied by Sperry-Rand's Ford Instrument Co division. Lewyt will consolidate his three Brooklyn plant operations in the new location.

H E B Machine Tools Inc has moved its sales and executive offices from New York City to 708 Clare St, Lansing, Mich, consolidating all H E B operations at the point of lathe manufacture.

Northrop Aircraft Inc, Hawthorne, Calif, has just been awarded $4.25 million in new defense contracts to make optical, fire control and armament equipment.

Frohman Mfg Co Inc, Southern gear manufacturer, has purchased **Detroit Broach Co's Turbine Products Division,** Boca Raton, Fla, manufacturer of motor and spline shafts, and jet aircraft tie rods and bolts. Frohman will operate it as its Turbine Products Division.

Chrysler Corp will buy the plant, equipment and inventories of **Universal Products Co Inc,** Dearborn, Mich, maker of automotive drive shafts and components. About 85% of Universal's output in recent years has gone to Chrysler.

Machinery Associates Inc has purchased the Fox and Abbotsford Ave plant of **Hall Planetary Co** in Philadelphia, will build a one-story plant on the 3-acre site, and will lease the existing building there to **Weidemann Machine Co.** Hall Planetary will continue operations at Germantown, Pa.

F Jos Lamb Co, 41-year-old Detroit builders of automation equipment, special machinery and multiple-drill heads, has been bought by a group of Detroit financiers.

Frank Piasecki, who formerly headed **Piasecki Helicopter Corp,** has formed **Piasecki Aircraft Corp** in Philadelphia. The firm will be engaged in aircraft research and development primarily.

Murray Corp of America, Detroit, has purchased the name, washing machine assets, inventory, sales and marketing organization of **Easy Washing Machine Corp.** Other assets of Easy will be merged with **Union Chemical & Materials Corp.**

Rheem Mfg Co, world's largest producer of steel shipping containers is entering the reconditioned drum business in California.

Baldwin-Lima-Hamilton Corp, Philadelphia, will close its Eddystone, Pa, iron foundry permanently. Closing of B-L-H's iron foundry, one of the nation's biggest, will not affect the company's non-ferrous foundry at Eddystone.

P M Industries, Stamford, Conn, has acquired **Instrument Motors Co,** Stamford manufacturers of small motors and permanent magnets.

Barry Controls Inc, Watertown, Mass, maker of vibration mounts, has purchased **Insco Co,** Groton, Mass, maker of electro-mechanical instruments and controls.

KEARNEY & TRECKER CORP APPOINTMENTS . . J Robert Jones (left), sales manager of the standard machine division, named, in addition, general sales manager of the company; and **John R Joerger,** recently on special assignment for the vice presidents of engineering, sales, and manufacturing, to head sales of the newly-established aircraft machine division

Kenneth R Herman, vice president and general manager of Vickers Incorporated, Detroit, has been elected president

Names in the News . . .

Walter J Niles, formerly president of SoundScriber Corp, New Haven, Conn, has been elected president, treasurer, and director of Kraus Automatic Machines Corp, Rochester, NY, manufacturer of automation machinery.

Donald R Guthrie, assistant general manufacturing manager of Minnesota Mining & Manufacturing Co's Coated Abrasives and Related Products Div, has been promoted to general manufacturing manager.

Rockwell Manufacturing Co's Delta Power Tool Div names: **Byron E Coon,** Western regional manager, to divisional sales promotion and merchandising manager; and **John P MacCrossen,** San Francisco district sales manager to succeed Mr Coon.

Leland Electric Co Division of American Machine & Foundry Co appoints: **Rex D Marsh,** sales manager, to vice president, sales; and **Walter T Buhl,** consulting engineer, to vice president in charge of engineering and manufacturing.

Rheem Manufacturing Co promotes: **William S Rheem II,** general manager in charge of the company's four operating divisions, to a vice president and board member; and **Gordon W Mallatratt,** general manager of the Rheem Products Div, to a vice president of the company.

Adolf A Widmann, associated with National Machine Products Co, Utica, Mich, since 1927, has been appointed vice president in charge of engineering.

Ken R Gerlach, formerly associated with the Sperry Gyroscope Co, has been appointed executive vice president of Bogue Electric Manufacturing Co, Paterson, NJ.

Paul E Beattie has been promoted from assistant to the president to vice president and general manager of O & M Machine Co, Los Angeles designer and manufacturer of airborne equipment.

Frank V Stauffer, field engineer with the Bellows Co, Akron, Ohio, manufacturer of work devices, has been appointed Detroit district manager.

V G Mulligan has been appointed general sales manager of Driv-Lok Pin Co, Sycamore, Ill, manufacturer of metal fasteners.

Alfred Fleissig, director of purchasing for Loewy-Hydropress, has been named to the additional post of general sales manager

F J Sikorovsky, formerly executive vice president of Avildsen Tools & Machines, New York, has been appointed general manager of Wood & Spencer Co's Tap Div, Cleveland

OBITUARIES

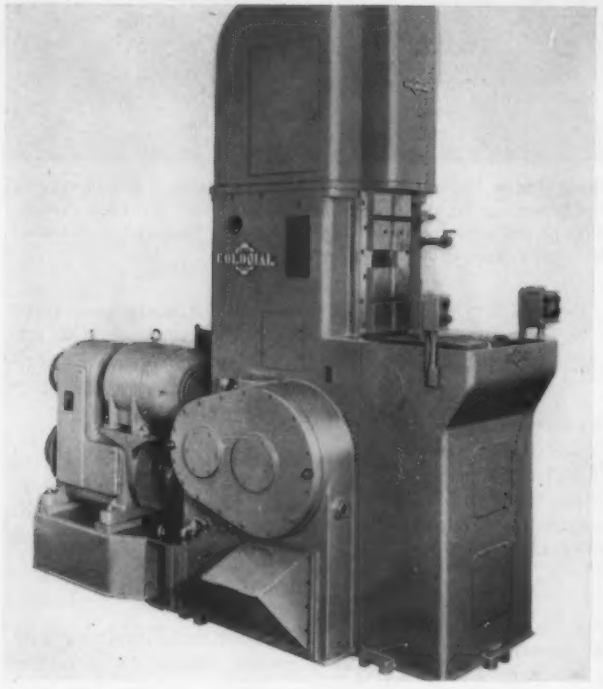
William F Zimmermann, 71, executive vice president and a director of Gould & Eberhardt, Irvington, NJ, manufacturer of gear-cutting machines and shapers, died July 9 after a short illness.

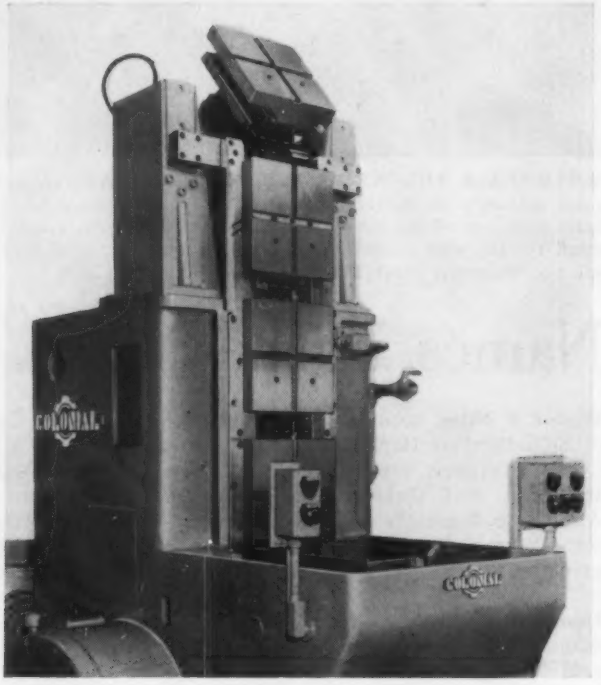
John Newton Fauver, 65, president and founder of J N Fauver Co, Detroit specialists in lubrication, filtration, and hydraulics, died July 6 in Detroit of a heart attack.

C Howard Paul, 61, vice president, secretary, and treasurer of Mackintosh-Hemphill Co, Pittsburgh, died July 3 following a heart attack.

D Angus Currie, 68, chairman and treasurer of Erie Foundry Co, Erie, Pa, died June 25.

New Shop Equipment





Broaching Machine Mounts Carriers on Endless Chain

Colonial Broach & Machine Co has announced a new broaching machine employing a different approach to surface broaching. The "One-Way" achieves virtually continuous metal removal by mounting a series of broach carriers on an endless chain.

Broach carriers move downward on the front of the machine, entering precision ways before contacting the work. Part being broached remains stationary in holding fixtures on work platen. After entering the ways, the broach carriers become individual rams. The chain applies only down-pull on the ram; gibs and ways support the ram while broach teeth are cutting.

The chain broach principle provides increased length of broaching stroke in a relatively small machine. Model VCA-10-150 stands 11½ feet high yet has effective broach length of 12 ft 10 in. Equipped with completely mechanical drive, including variable speed unit, machine has infinite variation of cutting speed from 10 to 50 sfpm.

Versatility is provided by the wide face for mounting broaches on the chain-mounted rams and the wide work platen to handle indexing or stationary fixtures. These features permit installation of multiple tooling for simultaneous broaching of the same or different parts side by side. If parts being broached require less than half the available stroke, duplicate tooling can be installed in sequence on broach carriers and controls modified to provide two or more complete broaching cycles for each revolution of the chain. With suitable broach spacing and control stops, two parts requiring a short stroke and one part requiring a long stroke can be broached side by side during a single revolution of the chain.

Some of the obvious features include: no return stroke of the broach, reducing over-all cycle time; tool life increased due to smoother cutting action provided by mechanical drive; accuracy within tenths; and no pit required for installation of the machine.

The unit makes use of a conventional ac motor and variable speed drive rather than the more costly dc equipment. Elimination of start and stop of drive motor and variable speed drive is accomplished with electric clutch in the drive mechanism. Lubrication is by force feed to all major wear points. Electrical controls are at the extreme front of the machine for easy access by operator. Safety interlocks are provided, depending on machine cycle desired.

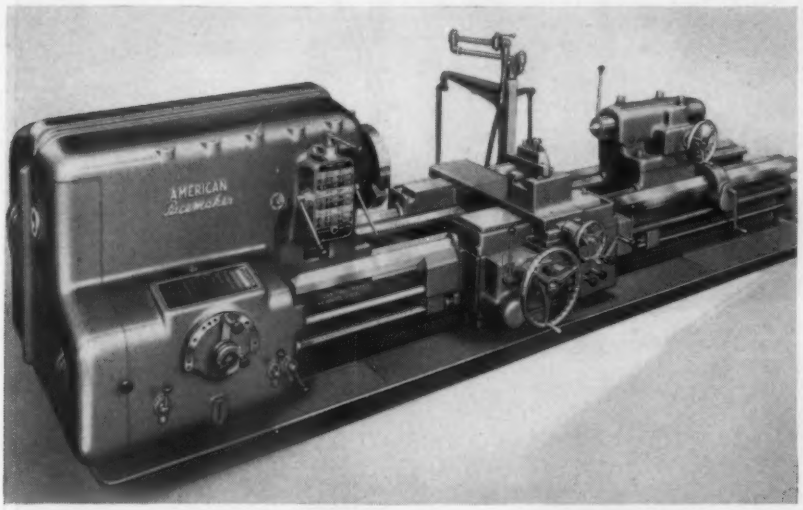
A specially designed floating head support for upper idler sprocket maintains proper chain tension. The tower of the machine is constructed so it can be raised with extension inserts, and a longer broach carrier chain installed to increase effective stroke by as much as 18 ft.

The basic model is 11½ ft high, taking floor space of 73x152 in. Work platen is 20x22 in.; height from platen to bottom is 63 in.

Colonial Broach & Machine Co, Box 37, Harper Station, Detroit 13, Mich

MORE DATA? Circle FYI 56, inside back cover

Materials and Parts . . .



American Adds 32-in. Lathe To Standard Pacemaker Line

The line of Pacemaker lathes has been expanded by the addition of the 32-in. style H model. It is said to be ideal for a large part of 32-in. conventional lathe work and for general maintenance and repair operations, to have been designed with special consideration to factors of power, ease of control, and inherent stamina. Power to take heavy cuts is provided by motors up to 40 hp. Every gear and shaft throughout the machine is hardened alloy steel, ground or machine lapped. All bearings are anti-friction.

Fingertip control of lever at right-hand side of apron starts, stops, brakes, and (when electrical reversing equipment is used), reverses the spindle. Similar lever at left-hand side controls the electrically operated power traverse to the carriage.

Three types of heads are available —27 speed, range 6 to 600 rpm; 18 speed, 7 to 600 rpm; and 9 speed to be used with adjustable-speed dc motor. The spindle has three bearings—Timken precision zero bearings at front and center, and floating ball bearings at rear. The front and center bearings are adjustable simultaneously from outside the headstock.

The quick-change gear mechanism cuts standard threads without transposing or adding gears. The totally enclosed mechanism provides a range of 60 threads and feeds from ½ to 30 tpi and feeds from 0.004 to 0.240 ipr.

The standard tailstock is massively designed, equipped with 5-in.-dia spindle and No. 6 Morse taper spindle. The oversized spindle is actuated by a rack and pinion and a self-locking wormwheel. To relieve the binder bolts of carrying all the thrust from heavy service, a pawl and ratchet mechanism is provided.

Power rapid traverse for the carriage is supplied by self-contained electrical unit built into the apron. It consists of a 1½-hp rolled shell type shaftless ac motor controlled by three-position switch. An important safety feature consists of a metal plate clutch in the drive to provide against accident should the carriage be inadvertently traversed into the headstock or tailstock.

A new taper attachment is available with longitudinal sliding members made of Meehanite, operating on hardened and ground steel guideways with Meehanite taper gibs.

The American Tool Works Co, Pearl St at Eggleston Ave, Cincinnati 2, Ohio

MORE DATA? Circle FYI 57, inside back cover

. . . including

MACHINES AND ATTACHMENTS

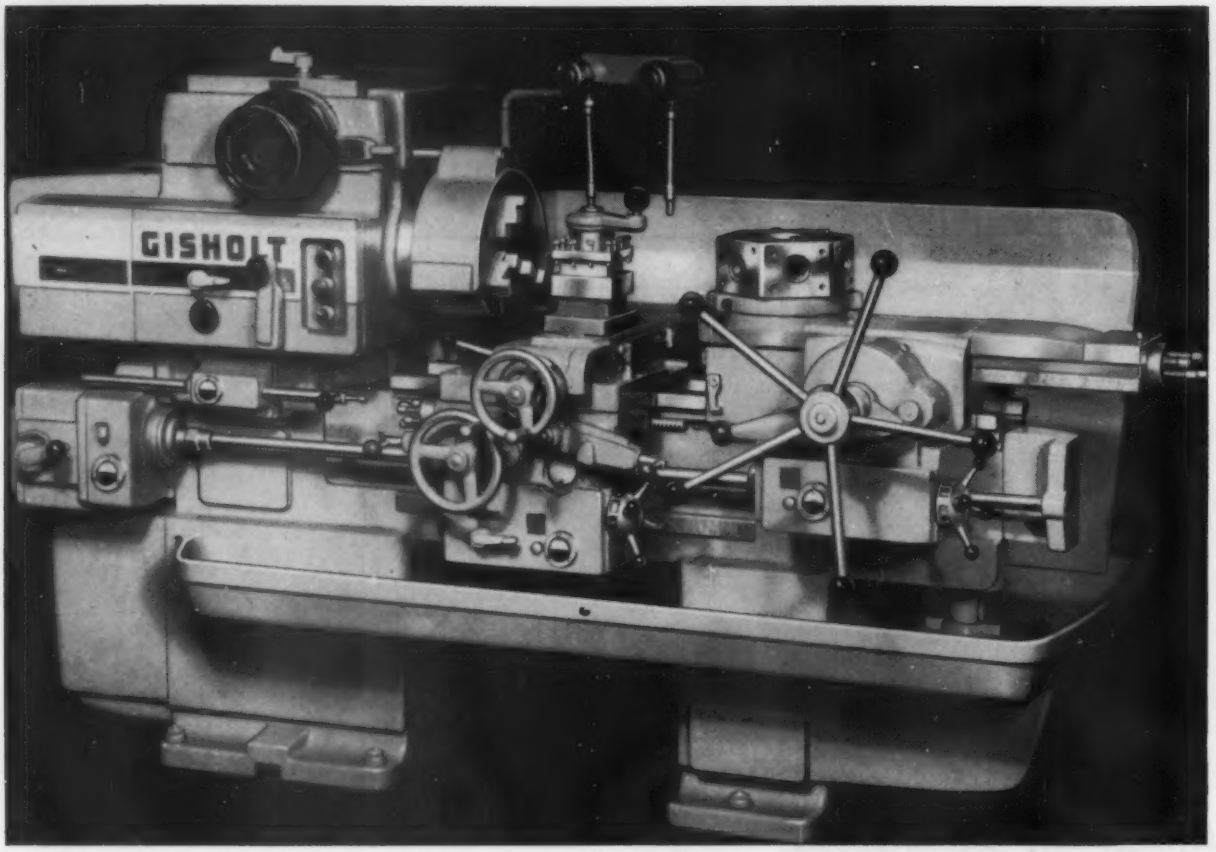
Ram-Type Turret Lathe ..... page 146
Drilling Machines ..... page 147
Dial-Type Special Miller ..... page 147
Metal Disintegrating Machine ..... page 147
Small Planer-Type Mill ..... page 148
Ball-Grinding Attachment ..... page 148
Press Feed ..... page 149
Drilling Work Station ..... page 149
Dual-Head Lathe ..... page 149
Vertical Miller & Jig Borer ..... page 150
Boring-Mill Worktable ..... page 150
Toolpost Grinder ..... page 152
Heavy-Duty Index Table ..... page 152

TOOLS AND ACCESSORIES

Toolmaker's Microscope ..... page 147
Machinist Clamps ..... page 149
Angle-Head Drills ..... page 150
Form Wheel Dresser ..... page 152

PLANT SERVICE AND PARTS

Electric Truck ..... page 147
Plate & Sheet Scrubber ..... page 150
Air Valve for Presses ..... page 152
Hoist-Control Instrument ..... page 152



Masterline Ram-Type Turret Lathe in Three Models

Completely redesigned to use today's carbide tools, and with some reserve for tomorrow's, three models of Masterline ram-type turret lathes will be shown in Chicago. The No. 3 has collet chuck for 1½-in. round, No. 4 for 2 in., and No. 5 either for 2½-in. or 4½-in. round. Any can be equipped with a Jetracer, one model mounting on the rear of the cross-slide, the other on a turret face.

The first three sizes have 8-in. spindle nose, the fourth an 11-in. An improved speed selector gives the No. 3 size 8 spindle speeds (formerly 6) from 40-1500 rpm or 53-2000, the other three 16 spindle speeds (formerly 12) from 30-1500 or 40-2000 (except for 4½-in. chuck, which has only 30-1500). Swing over ways for the two smaller machines is 19½ in., over the cross-slide 10⅝ in., for the two large machines 21¾ and 12⅛ in. respectively. Longitudinal travel of the slide carriage is 19⅛ in. for the two small machines, 26⅛ for No. 5-2½, and 25⅝ for No. 5-4½. Cross travel of the cross-slide is 10 in. for the two small units, 10½ in. on the two No. 5's. Square turret is 5¼ in. wide and uses a ¾ x 1¼-in. tool. Both hex and square turrets have eight feeds, from 0.003 to 0.042 in. Max distance turret face to spindle flange is 26¼ for the No. 3 and No. 4, and 33 and 32½ in. for the two No. 5's. Effective turning length for the turret is 10 in. for the No. 3, 12 in. for the No. 4, and 14 in. for the No. 5.

MODEL CHANGES

A heavier bed and headstock of new design includes wider bedways, hardened and ground (64 R_c). A CI chip pan makes a 1-piece casting with motor and coolant-reservoir legs, gives greater rigidity.

Triple gears have been eliminated, and instantaneous speed change has been shifted to 8 to 1 ratio. A hydraulic brake is mounted on the spindle, but the spindle can be freed for hand rotation by a lever on the headstock, while another lever provides "inching." All four headstocks are hydraulic multiple-disk units to eliminate constant adjustment.

Both aprons are enclosed, have cascade-lubricated gears, and give any of the eight feeds (0.003 to 0.042 ipr) by handwheel, eliminating the former coarse-fine lever. A push-button on each apron sends pressure lube to front and rear ways and cross-slide ways of the side carriage and saddle ways for the turret ram.

Side carriage is now equipped with a moving handwheel, so the cross-slide handwheel moves in and out with the slide. Swing over the slide is increased to take a 10-in. chuck on the two smaller sizes, a 12-in. chuck on the largest. The crossfeed nut is adjustable for backlash.

The hex-turret saddle is wider to broaden the base for the turret ram. The turret is on a large-diameter plain bearing, has coolant piped to all faces automatically.

Chasing attachment for the side carriage disengages automatically, is of the leader and follower type, with 1⅜-in.-dia feed rod. Feed rod runs at ¼ spindle speed, so a leader will cut a thread four times its own pitch. The turret threading attachment replaces the former leader with a leadscrew, long enough to permit threading at any point along turret travel. With selective gearbox, threads two and four times leader pitch can be cut, giving 4 or 8 tpi with a 2-pitch coarse leader, 20 or 40 with a 10-pitch fine leader.

Collet chucks are now hydraulic, as are the bar feeds. The single-speed driving motor is 10 to 30 hp.

Gisholt Machine Company, Madison 10, Wis.

MORE DATA? Circle FYI 58, inside back cover

Cincinnati Drilling Machines Designed With Sliding Heads

Cincinnati 16-in. sliding-head bench, floor, and multiple-spindle drilling machines incorporate a simple selector which obtains any of four rates of feed engaged through positive-jaw clutch. The power feed mechanism is completely housed in the head. A new direct-reading depth dial with positive stop may be set to disengage feed automatically.

The spindle is full-floating, mounted in precision, sealed ball bearings. V-belt drive transmits motor power directly to the spindle. A tilting motor bracket is provided to make spindle speed changes easy. Contour-fitting belt guard is standard.

Drills are rated at 1 in. in cast iron with a 1-hp, 1800-rpm motor. No 2 Morse taper spindle is standard, with No. 3 optional.

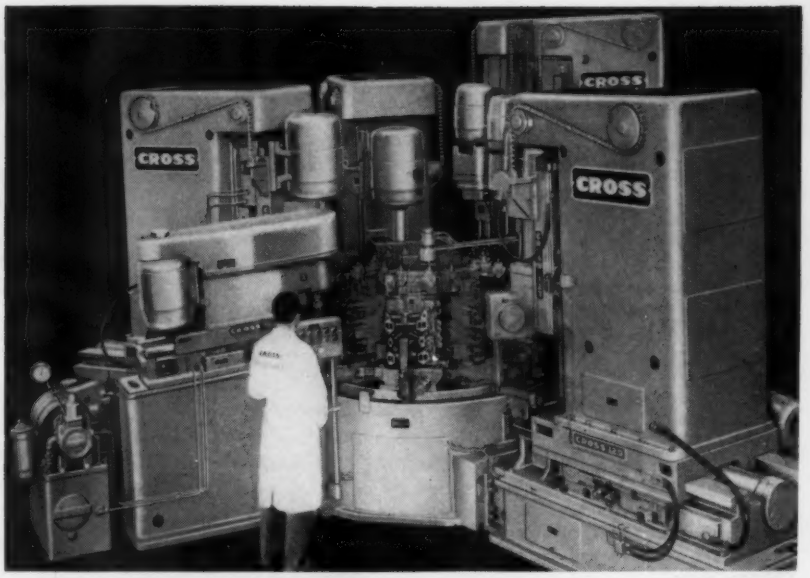
Cincinnati Lathe & Tool Co, Cincinnati 9, Ohio

MORE DATA? Circle FYI 59, inside back cover

Toolmaker's microscope permits precision measuring of coordinates to 0.0001 in., angles to 1 minute of arc, in addition to radii, concentric circles, screw threads, etc. Measuring stage has range of 1-1/2 x 2 in. with 1-in. large micrometer drums reading in 0.0001 in. Additional movement in both directions is obtained by use of gage blocks. Variety of ocular heads available can be quickly interchanged.

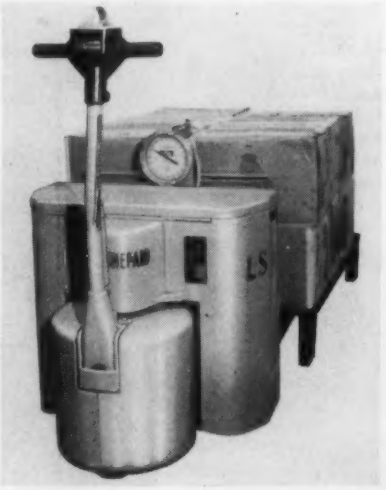
George Scherr Optical Tools, Inc, 200 Lafayette St, New York 12, NY

MORE DATA? Circle FYI 60, inside back cover



2- AND 4-BARREL INTAKE MANIFOLDS are semi-processed by this dial-type special which rough- and finish-mills the mounting faces, and mills, drills, and chamfers water outlet pad of manifolds. Unit has 145-pieces-per-hr capacity, uses 7 stations: 1 loading, 4 milling, 1 drilling, 1 chamfering. Features: hydraulic power clamping for workholding fixtures; automatic retraction for milling cutters; gravity-operated cam clamping for indexing table; and preset tools to reduce downtime. Process is finished in a second machine, Transfer-matic—*The Cross Co, Detroit 7, Mich*

MORE DATA? Circle FYI 61, inside back cover



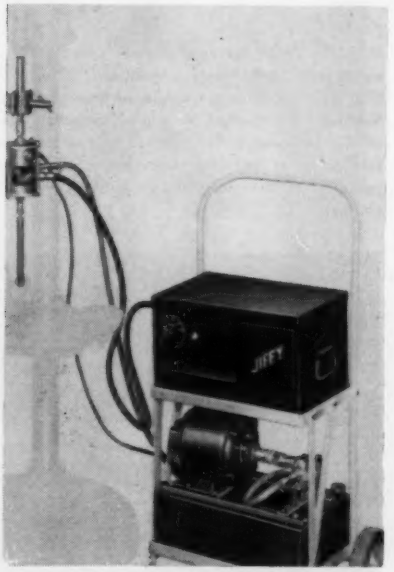
Electric Truck Equipped With Load-Scale Attachment

The JackLift Electric, a low-lift, platform, walkie truck, is equipped with a load-scale attachment which indicates weight of load when it is picked up.

Model, furnished in capacities up to 6000 lb, is only 32 in. wide at front end. The 25-in.-wide platform is available in the following lengths: 30, 36, 42, 48, 54, 60, 72 in. Vertical lift is 4 in.

Lewis-Shepard Products, Watertown, Mass

MORE DATA? Circle FYI 62, inside back cover



Metal Disintegrating Machine

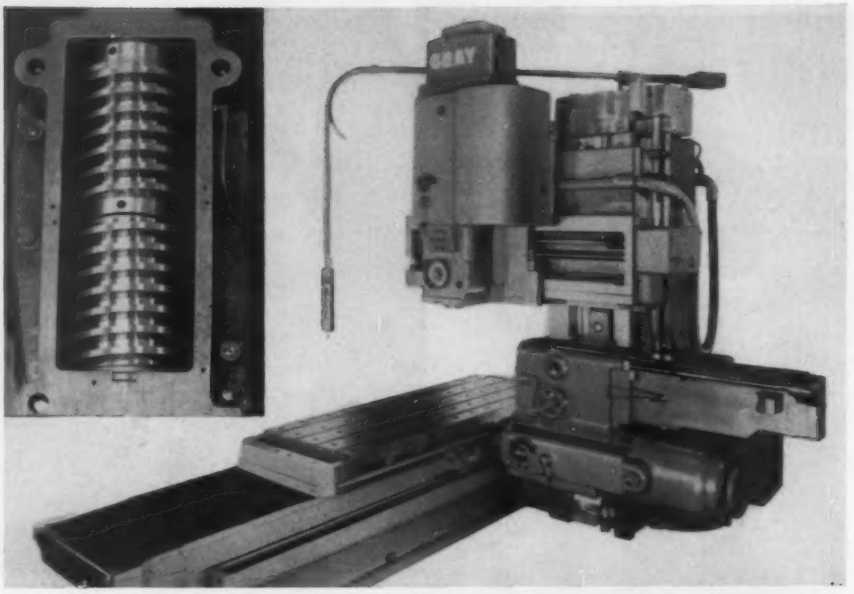
Jiffy Disintegrator design permits fast, efficient operation without use of electronic tubes, rectifiers, or condensers.

Machine quickly and completely removes broken taps, drills, etc, as fast and efficiently according to the manufacturer, as similar units of considerably higher cost.

Jiffy Disintegrators Inc, 109 E Nine Mile Rd, Detroit, Mich

MORE DATA? Circle FYI 63, inside back cover

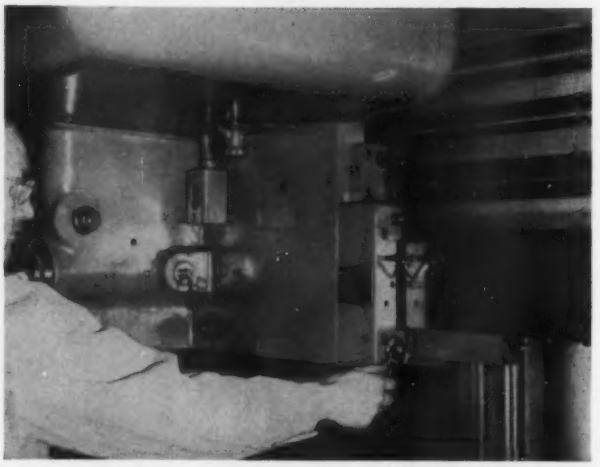
DESIGNED TO FILL THE GAP between large millers and small planer-type millers, the 36-in. by 8-ft Gray open-side Handymill has a non-swiveling milling-rail head with 25-hp motor and 8 1/8-in. quill, both automatically locked by Hydro-Lock, a self-contained hydraulic setup. Maximum width from edge of column to center of vertical spindle is 47 in., max height under the spindle nose is 39 in. The table is 36 in. by 98 in., with feed ranges of 1/2 to 200 ipm. Head feeds are 1/4 to 100 ipm, spindle speeds 10 to 1000 rpm under lever control. Anti-backlash table drive (inset) is a double spiral gear assuring 14-tooth engagement with table rack. Half the gear is splined to permit endwise movement to eliminate backlash. Gear is form ground and precision lapped. The machine will be at the Chicago Show

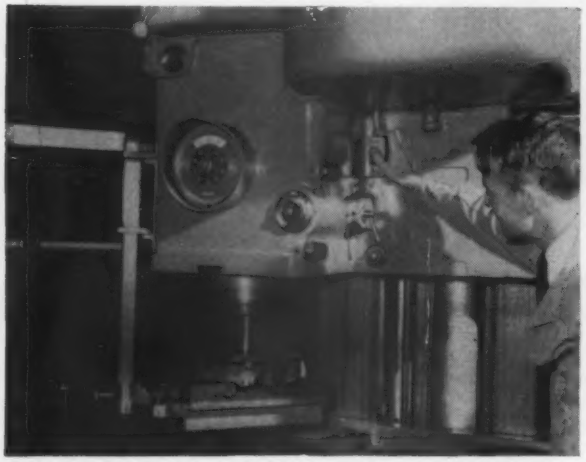


Gray Handymill

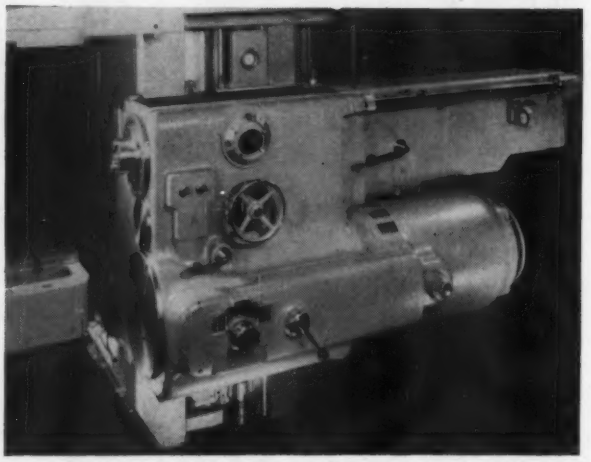
An In-Between Size

MATCH-MAKER assures perfect spindle alignment through a single-tree that alters adjustment of opposed tapered gibs that bear against the guide surface of the member on which the head is mounted. A wrench adjusts spindle train to avoid offsets between cutter passes, to overcome varying cutter performances in varying materials, and the like. The operator, rather than the maintenance man, does the job and has dial control





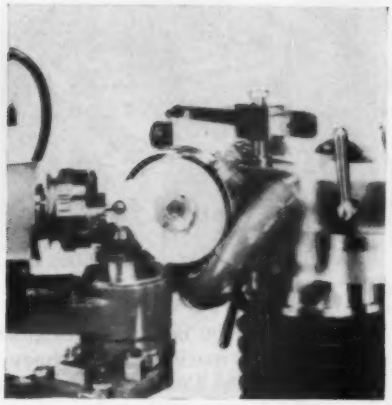
SKY HOOK is an auxiliary carrier for large cutters and attachments. The upper arm carries a link for a jib crane and the side bar a sliding handle with two pins that enter sockets in a plate on the machine head. The lower carrying bar swivels on the side bar so the load can be swung into place under the spindle, then lifted into the nose by power drawbar. In center is the new Micro-Meter indicator to show axial quill position. It registers to 0.001 in., makes zero positioning easy



BORING SIDE HEAD has 21 spindle speeds, instantly adjustable, from 10 to 1000 rpm. The 5-in. Nitralloy spindle can be adjusted 30 in. axially. Multi-depth stop permits accurate production repetition. Automatic indexing is provided. Drive is 25 hp. Head combinations vary as required. For example, there may be rail head only, rail and side milling heads, side head without knee and rail (and rail head). Way and elevating-screw guards, chip conveyor, and pendant control of feed and traverse are provided

The G A Gray Company, 3611 Woodburn Ave, Cincinnati 7, Ohio

MORE DATA? Circle FYI 64, inside back cover



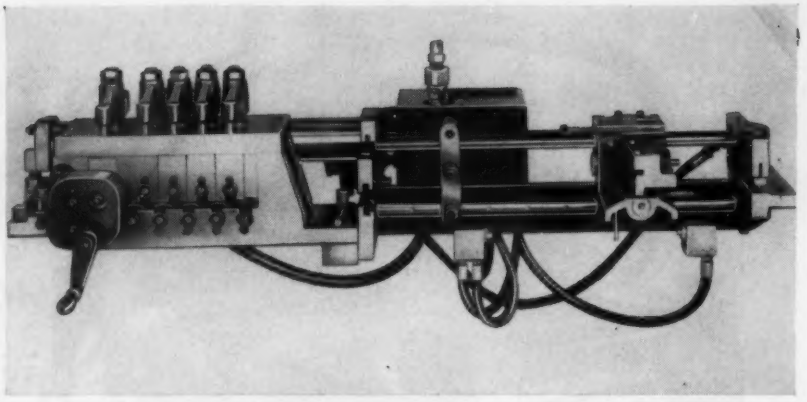
Ball Grinding Attachment

Jungner (Swedish) ball grinding attachment for grinding spherical plug gages, balls on shaft ends, and most types of circular work, has been designed for use on surface or tool-grinding machines. Unit has a built-in diamond setup gage.

Model is furnished with a precision 3-jaw chuck with a repetitive accuracy of 0.0001 in., and a 220-v, 3-phase, 60-c, 340-rpm motor. Spherical capacity is 2½-in.-dia; capacity of chuck is from 1/16 to 3 in. Max shaft capacity is 8 x ⅝ in. Taper hole in workhead spindle is No. 4 Morse.

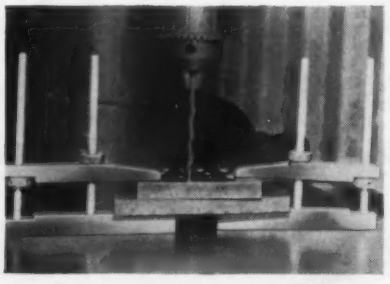
Nife Inc, Copiague, NY

MORE DATA? Circle FYI 65, inside back cover



AIR-OPERATED SLIDE FEED with 2½-in., nine-roll plain stock straightener attached, is available in five sizes with lengths of feed up to 36 in. Open throat enables stock up to 18 in. in width to be fed. Units can be timed from press crankshaft or ram, or may be installed to operate press. May be mounted so press can be tripped on any pre-determined lengths from a short feed. Feeds will operate on either side, front, or back of press, or may be used on special applications — *Cooper Weymouth Inc, 277 Noble Ave, Bridgeport 8, Conn*

MORE DATA? Circle FYI 67, inside back cover



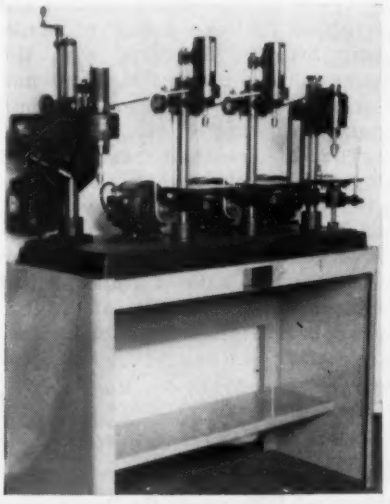
New Clamps Eliminate Parallels

Parlec machinist clamps with lower jaws precision ground to be parallel one with the other, and also with the worktable, eliminate the necessity of using parallels.

Jaws are made of 1020 steel, case carbonized. Studs are plated. Tightening nuts adjust positively against the top jaw, keeping all adjustments above the work. Lower nut has four pin holes for easy adjustment; a quick turn releases pressure. Parallel and right angle V's are milled in lower jaws for holding round stock materials. Clamps are available with opening between jaws from 3½ max in smallest to 7 in. in largest.

Universal Tool Co, Hawthorne, Calif

MORE DATA? Circle FYI 66, inside back cover



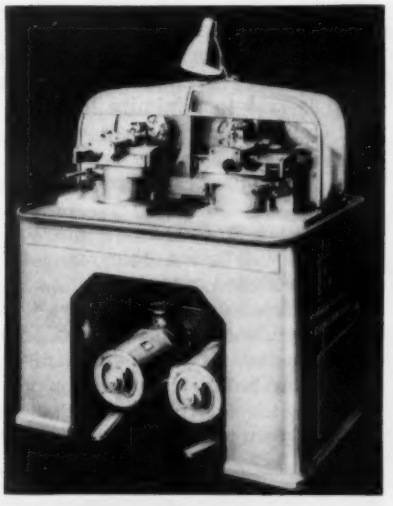
Production-Line Operations Combined in One Work Station

Hamilton Tool Co combines specific production line operations into a single work station. Unit illustrated comprises one Hamilton Varimatic super-sensitive drilling machine, two "A-M" super-sensitive drilling machines, and one super-sensitive tapping machine. Each is equipped for a specific duty in the production drilling, reaming, tapping operation.

Manufacturer states that such arrangements not only speed work and focus responsibility under one operator, but result in added economy through planned omission of details which, on individual machines, would be standard equipment.

Hamilton Tool Co, 830 S Ninth St, Hamilton, Ohio

MORE DATA? Circle FYI 68, inside back cover



Semi-Automatic Lathe Has Dual-Head Arrangement

Swiss-built Kummer MR 6020 incorporates a dual-head arrangement to permit turning of the most intricate forms, and faster machining time.

Operator loads the work into the chuck, actuated by a pedal, and engages the slide motion and spindle drive by depressing the starting handle. Head automatically stops at end of each cycle. During the operation of the first head, operator changes the work in the stopped second head. Coordinate cam action insures precision control of cutting tool. Speeds are up to 3500 rpm. Capacity of chuck—2½ in.—can be increased with special devices available.

Carl Hirschmann Co, 30 Park Ave, Manhasset, NY

MORE DATA? Circle FYI 69, inside back cover

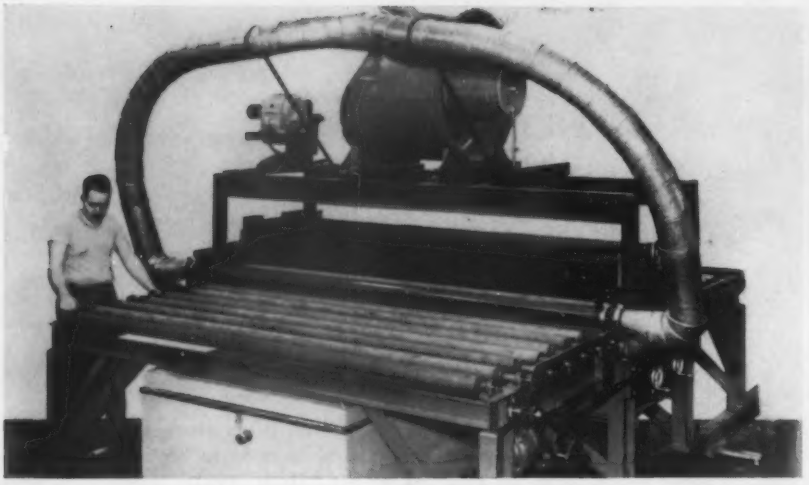


Plate and Sheet Scrubber Cleans Stock at 12 fpm

For companies working with sheet or plate materials—metals, plastics, glass, etc—where chips, oil film, dirt, polishing compound, and similar contaminants are likely to mar the surface during forming, or interfere with finishing operations, this machine is said to minimize the problem. Only minor modification is necessary to suit the machine specifically to a particular problem or material.

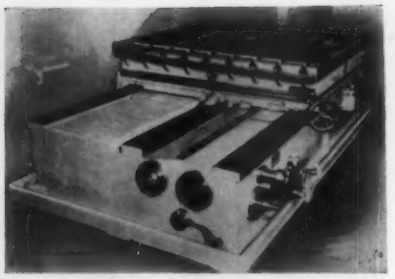
Usually, a thorough scrubbing operation will more than pay for itself in reduced manufacturing cost. It simplifies handling, increases tool life, permits more consistent tool action, minimizes scratching, lengthens plating-bath life, and cuts painting rejects.

Materials up to 8-ft wide are processed at 12 fpm. The plate or sheet is moved by feed rolls under a hood, where it is sprayed top and bottom with a heated detergent solution and scrubbed between a pair of horsehair brushes. Spraying with the same solution is repeated as the material proceeds between a second pair of rotating brushes.

Then the scrubbed sheet is rinsed top and bottom with a clear-water spray. Finally, it passes between two air manifolds where a blast of air squeegees it clean and dry and the sheet moves onto a conveyor-roll system. A second model of the machine provides brush scrubbing during the rinse.

The Fuller Brush Co, Machine Div, Hartford 2, Conn

MORE DATA? Circle FYI 70, inside back cover



Rotary Worktable

Model DAV 1600 has been designed to facilitate machining of heavy components in different planes on floor-type boring mills.

Table is a heavily ribbed box section, 51 in. wide, and is equipped with three flat ways; center way acts as a longitudinal guide for the saddle. Longitudinal and rotary feed movements of 0 to 38 ipm are effected over an infinitely variable drive. Fine manual adjustments are controlled by two handwheels. Gearing is protected against dirt and chips by covers fitted on the bed.

Special mechanism permits table to be locked and clamped by single handwheel, which, when rotated in the opposite direction, releases and relieves the table with minimum of effort. This feature facilitates circular milling work. Index stops are provided at the 90° positions.

Scharmann Machine Corp, 337 Boulevard of the Allies, Pittsburgh 22, Pa

MORE DATA? Circle FYI 72, inside back cover

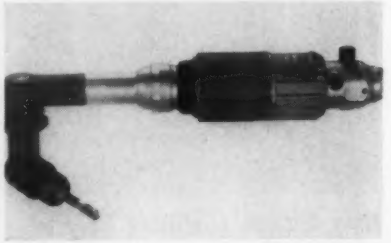
Vertical Miller and Jig Borer For Precision Mass Production

Model MC-1, for high production or prototype work, has been designed for ease of operation and maintenance, greater rigidity, flexibility, and extreme accuracy.

Tapered spindle bearing and hardened ground tool steel ways give chatter-free and vibration-less operation even when making heavy cuts with carbide tools, according to the manufacturer. Machine has 12 spindle speeds ranging from 80 to 3450 rpm. Guaranteed accuracy of movement and plane to within 0.00025 is made possible by the 6-in.-dia working dials and the hardened, ground, lapped, and stabilized leadscrews. All castings are heat-treated Meehanite.

Linochine Products Corp, 145 42nd St, Brooklyn, NY

MORE DATA? Circle FYI 71, inside back cover



Air-Powered Angle-Head Drills

Two new series of heavy-duty angle-head drills for use in confined or obstructed areas have been introduced by Buckeye Tools.

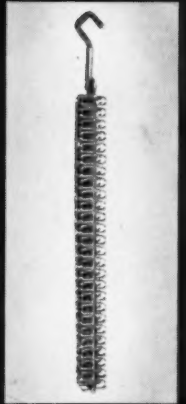
Rated at ¼ in. capacity, these portable air-powered units are furnished with either 90° or 360° angle heads. The latter can be locked in any position within full circle, permit drilling at any angle. Features include low tool head height.

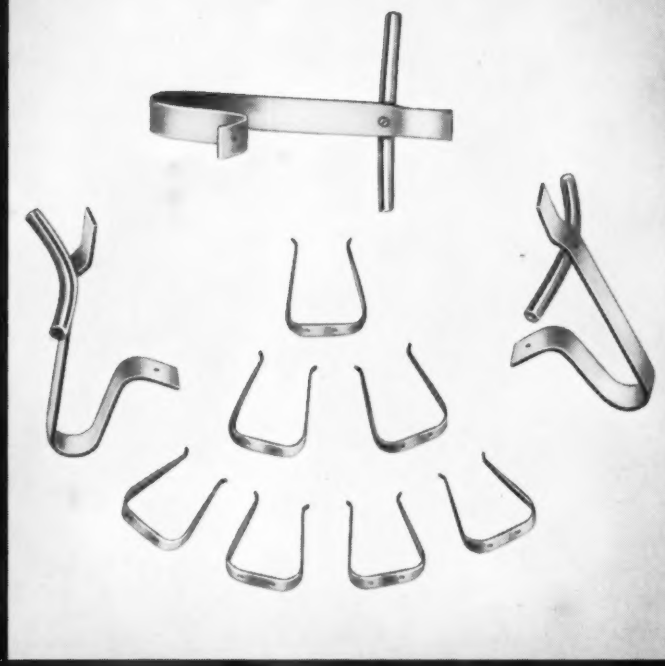
Both series are available in lever or lock-button throttle models with choice of seven speeds, 3500 to 300 rpm, and with ¼ in.-28, 5/16 in.-24, or 9/32 in.-40 spindles.

Buckeye Tools Corp, Dayton, Ohio

MORE DATA? Circle FYI 73, inside back cover

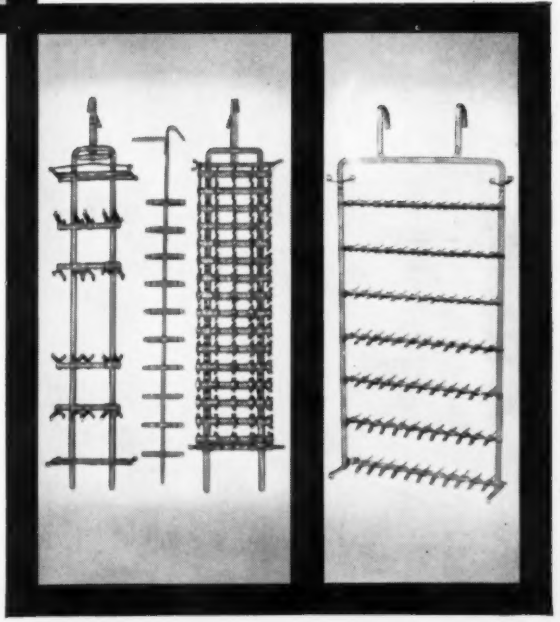
Spring quality of
REVERE
PHOSPHOR BRONZE
—important to Higgins Rack





When small parts have to be plated, the problem arises as to how to hold them on the plating racks. If they are not heavy enough to hang by their own weight, spring clips must be used. For such clips, the Higgins Rack Coating Mfg. Co., Hazel Park, Mich., uses spring temper Revere Phosphor Bronze Strip. This material is specified because its spring temper gives it the ability to withstand repeated flexing, so that the clips can be used repeatedly, and that small parts can be snapped in and out of them quickly and without distortion.

The racks to which these clips are attached are made of copper bar; the clips are fastened by riveting and soldering. Everything except the contact points of the clips is coated to prevent deposition of the plating metal and loss of current. Higgins is an important supplier of these special racks to the automotive industry, which uses them to plate both interior and exterior trim. The efficiency and economy of this method helps make handsomer cars and trucks as well as numerous other attractive consumer commodities.



Clips and racks made to special designs by the Higgins Rack Coating Mfg. Co., which buys Revere Phosphor Bronze Strip for the clips from Copper and Brass Sales, Inc., a Revere Distributor in Detroit, Mich.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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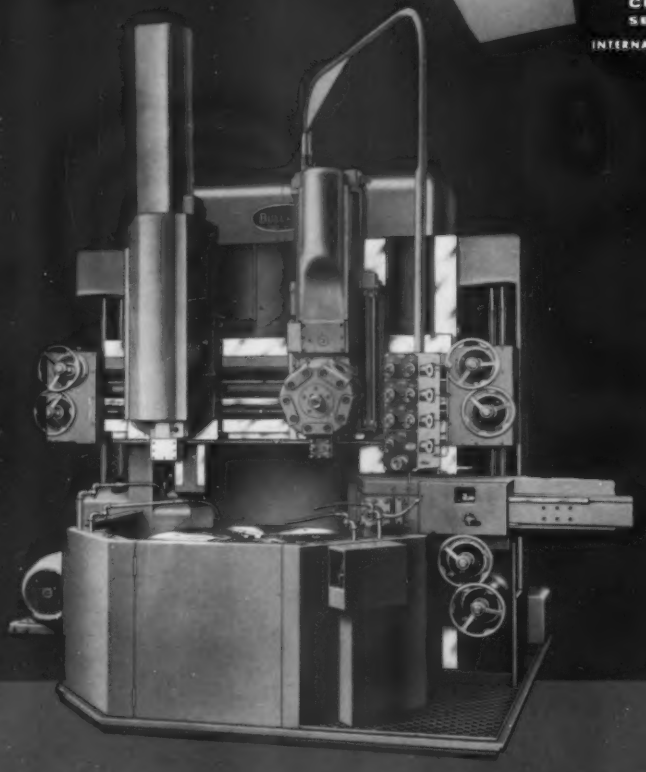
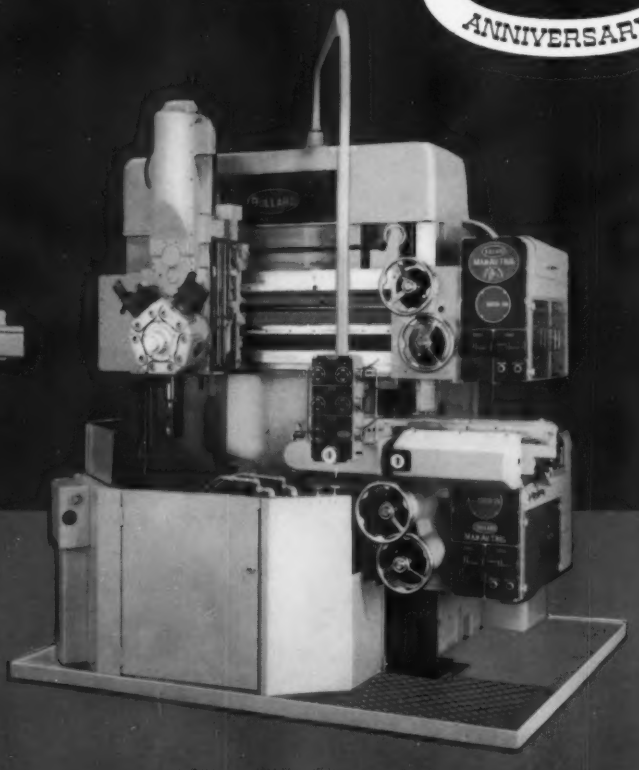


CUT MASTER V.T.L., Model 75

In six sizes, 26" to 76"
table diameters in 10" increments.
Various combinations of heads are available.

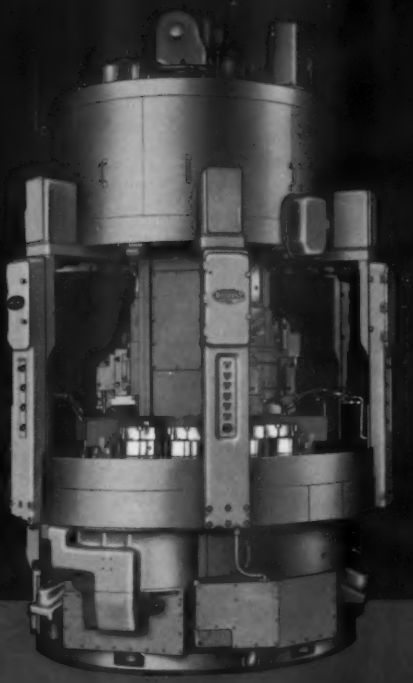


MAN-AU-TROL, Model 75

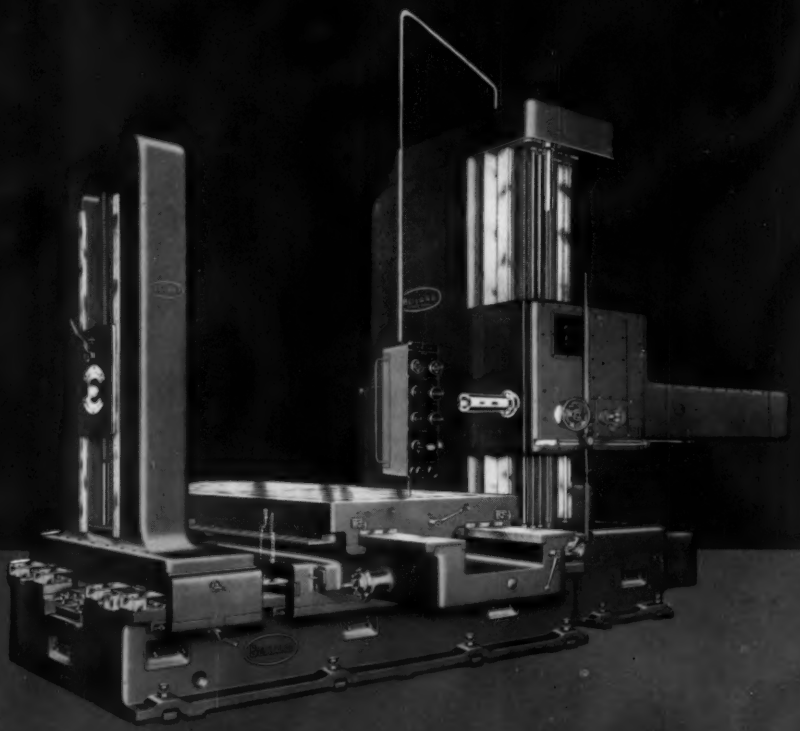
For fully automatic operation—may be applied to any or all heads of Cut Master V.T.L. Model 75 at time of ordering or in your plant at a later date.

You will see the Most Modern Line of Machine Tools available to the . . . Metal Working Industries . . .

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT



MULT-AU-MATIC TYPE "L"
10" with 6, 8, 12 or 16 spindles, 14" and 18" with 6 or 8 spindles. Automatic loader.

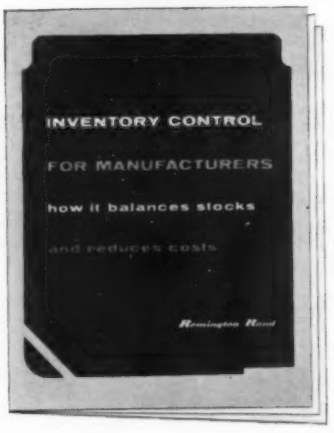


HORIZONTAL BORING, MILLING AND DRILLING MACHINE Model 75
3" 4" and 5" spindle — Available in many combinations of bed lengths, vertical capacity and table size. Automatic positioning.

Get your free copy of this new booklet

INVENTORY CONTROL FOR MANUFACTURERS

How It Balances Stocks And Reduces Costs



THIS NEW comprehensive, illustrated booklet, "Inventory Control For Manufacturers," is filled with the most effective, modern techniques for balancing stocks and reducing costs.

Inventory represents about one-third of the capital invested in manufacturing and usually is the largest item on the balance sheet outside of plant and equipment. OVERSTOCKS result in increased investment, useless tying up of capital, increased insurance, the use of more floor space for storage purposes, deterioration and obsolescence, and other substantial losses. UNDERSTOCKS result in lost sales, extra expense of "rush" orders and last minute buying, and idle shop time waiting for short and undelivered material.

Don't miss this opportunity to get the full picture of what Inventory Control means to Management, Production, Purchasing and Sales. Upon inventory availability and adequacy depend scheduling, workflow and delivery – even such human factors as job stability and good labor relations. Inventory Control is the backbone of all manufacturing operations.

No two plants have the same problems but the principles of a good inventory control record as outlined in this booklet, may be profitably adapted and applied to the needs of any business.

Write today for this new booklet. Ask for KD406– "Inventory Control For Manufacturers . . . How It Balances Stocks and Reduces Costs." Remington Rand, Room 1836, 315 Fourth Avenue, New York 10.

Remington Rand

DIVISION OF SPERRY RAND CORPORATION

This Case of "Unprovoked Assault" Cost

*$2,010 in compensation alone — that's what it cost a southern machinery manufacturer when a turret lathe operator was struck in the left eye by a flying chip. A surgeon had to remove the eye. Apart from the humanitarian aspects, the pity of it all is that an AO† metal side shield spectacle goggle, for instance, costing at an average of about $2.30 would have prevented this accident. Even if this company had protected the eyes of the entire department (Cost: under $150) they would now be ahead by more than $1,860!

AO trademarked safety lenses are heat treated and individually tested to prevent accidents like this. The AO trademark on frames is another guarantee of quality eye protection. Ask an AO Safety Representative to show you where the eye hazards are in your operations . . . what can be done to meet them . . . and how little quality protection costs. (It can pay for itself within 6 months time.) Or write American Optical Company, 5138 Vision Park, Southbridge, Mass., for booklet.

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BRANCHES IN PRINCIPAL CITIES

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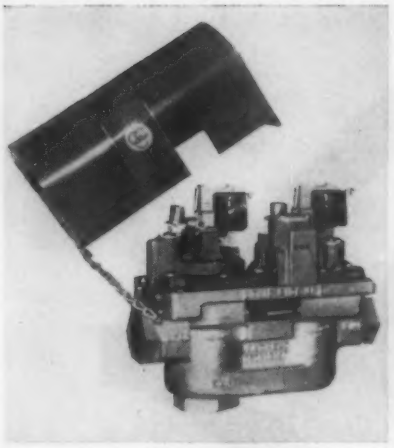


Clark Clutch Valve Makes Presses Safer

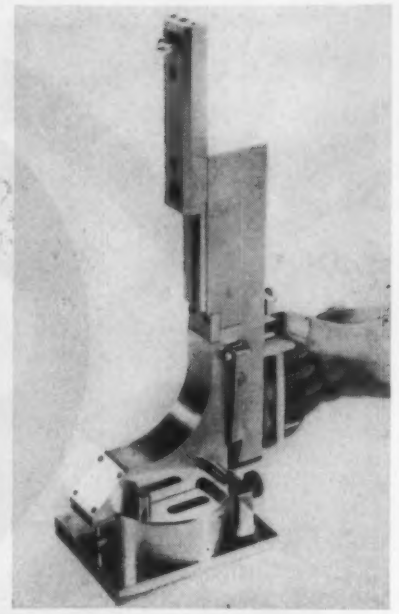
Dual air valve for presses with air clutches or brakes has one operating unit, which moves with each press stroke, and one safety unit that stands by, actuated only if the operating unit fails. Feature reduces wear on safety section, making simultaneous failure unlikely.

Type PV is a 1¼-in. pilot-operated valve for pressure from 25 to 100 psi on 250- to 2500-ton presses. Electromagnets are for 110 volts, though coils for other voltages are available.

The operating unit works with a pilot controlled by the press. The safety unit includes a permissive pilot that intercepts the signal fed back from the press control and forwards it to the operating unit if the mechanism is working properly. All mechanisms are automatically checked at each press stroke, making the valve proofed against ruptured diaphragms, burned-out electromagnet coils, jammed operating levers in the two pilots, and failure of operating unit or either pilot to close fully.

Clark Controller Co, Cleveland, O

MORE DATA? Circle FYI 51, inside back cover



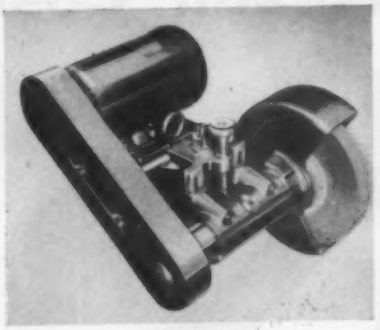
Fluidmotion Form Wheel Dresser Has Diamond Elevator Extension

Model H, when used for form dressing surface grinder wheels, increases the range of diamond positions, allows a wider adjustment range, and permits elevation adjustment of up to 6 in.

For internal grinding wheel applications, the wide adjustment permits adaptation to many types of units, such as Heald, with its 10¼-in. center, and Bryant, with its 6-in. center, without extra attachments. Dresser processes cylindrical and surface wheels from the smallest up to 24-in.-dia.

J & S Tool Co, 87-5 Dorsa Ave, Livingston, NJ

MORE DATA? Circle FYI 54, inside back cover



Toolpost Grinder Converts Any Machine to External Grinder

New 3-hp toolpost grinder for heavy duty cylindrical and surface grinding swings wheels up to 12-in.-dia by 1½-in. face at speeds of 1750 rpm.

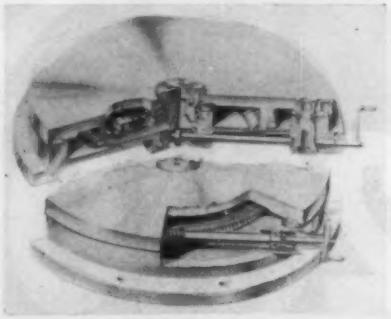
Series 25 converts any basic machine tool into a precision external grinder and is designed for mounting on lathes 20 in. or larger, planers, shapers, vertical boring mills, etc. Constant speed induction motor is furnished with built-in magnetic starter and over-load protector. Cast iron frame provides rigid vibration-free mounting.

Quill, 3-in.-dia, is machined from solid bar stock and is equipped with large over-size Timken tapered roller bearing, grease lubricated and preloaded at factory. At 1750 rpm, bearings have radial capacity of 955 lb, thrust capacity of 655 lb. Double V-belt drive transmits power from motor to quill.

Center line of spindle to center line of mounting post is 3-37/64 in. Quill adjusts vertically 1⅝ in. for quick wheel centering by turning hand-wheel. Available for 220 or 440-v, 3-phase, 50/60-cycle, ac operation.

Dumore Precision Tools, Racine, Wis

MORE DATA? Circle FYI 52, inside back cover



Positive Locking Index Tables Are Hand or Power Operated

Index tables, designed for heavy-duty work, are said to be particularly adaptable for milling, drilling, or similar operations where lack of vibration is a necessity.

Base and top plates are Meehanite castings with hardened surfaces for ball races. Table runs on a hardened steel thrust ring, and a pilot is provided for locating fixtures. Shot pin and locking device are actuated by one operating handle. Equalizing cam action assures concentricity and parallelism. Top plate rotates freely and easily. Wheel and worm gear, operated through a hand-wheel, provide easy movement.

Sesco, Inc, 8881 Central, Detroit 4, Mich

MORE DATA? Circle FYI 53, inside back cover

Hydraulic Instrument Controls Load Hoisting and Lowering

Hydra-Set unit applies as a link between the hoisting mechanism and the load. It will raise or lower loads with accuracy to within 0.001 of an inch, independent of crane or hoist control system, by means of up or down control levers which can also be operated by remote control reels, when required.

Hair-line control in precision mating allows the crane to be preloaded slowly and accurately, freeing mating parts before crane is operated. In production assembly it is also possible with two or more individually operated units in cling lines, to level a suspended load. Instrument also serves as a crane scale, weighing the load as soon as it is suspended.

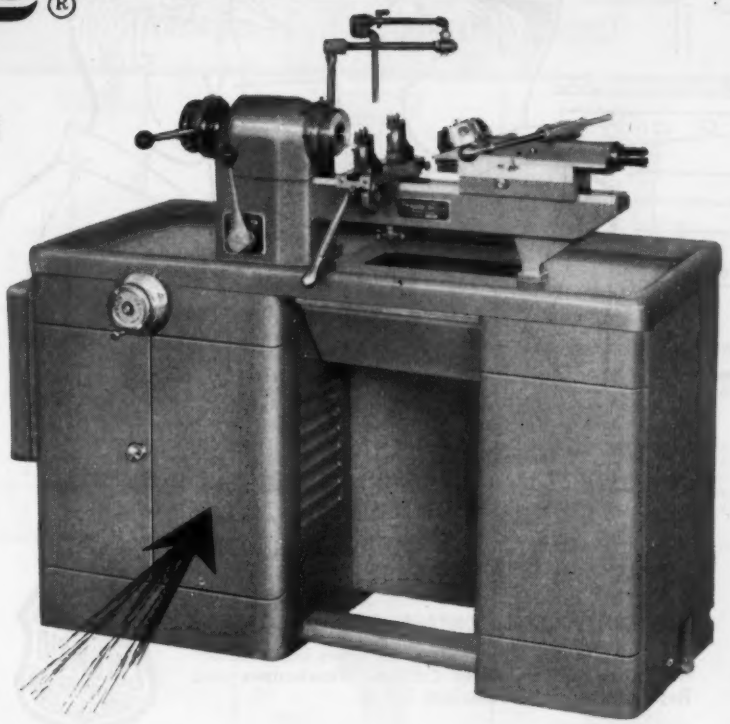
Mefco Sales & Service Corp, 1509 Gardena Ave, Glendale 4, Calif

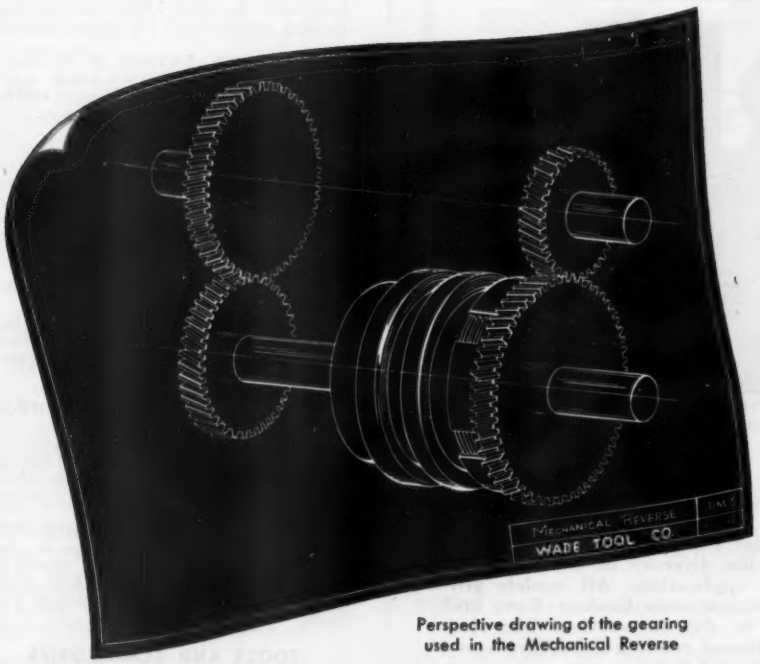
MORE DATA? Circle FYI 55, inside back cover

the Wade® REVERSE *

CONTINUOUS REVERSE

The arrow indicates the location of a feature that is built into the Wade #73, and **obtainable on no other second operation machine . . .** it's the production-tested **Mechanical Reverse.**





Perspective drawing of the gearing used in the Mechanical Reverse

no. 73 Hand Turret Lathe

A single lever mounted on the lathe bed not only controls the high-low spindle speeds of 5-to-1 ratio, but it also actuates the Mechanical Reverse. This lever brakes the headstock spindle and throws it into reverse **without stopping and starting the motor!**

Cycles of up to 32 reversals per minute allow production increases of as much as 100% on your tap or die work.

If this feature interests you, investigate the full advantages of the Wade No. 73 by writing today for a circular illustrating this versatile machine.

*Wade Exclusive, Patent applied for

write for descriptive folder and prices | **53 River St.**

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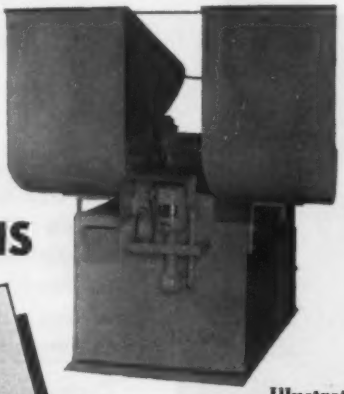
COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

FOR A WIDE DIVERSITY OF APPLICATIONS



Ruthman GUSHER Coolant Pumps

Illustrated is a SUN Glass Grinding Machine equipped with a Ruthman Gusher Coolant Pump.

MODEL 11022

Gusher Coolant Pumps are versatile. They come in a wide diversity of models to fit almost every application. All models give the same instantaneous Coolant flow, and efficient day in, day out service. The electronically balanced rotating assembly, heavy duty pre-lubricated ball-bearings assure you of long, trouble-free service at minimum maintenance cost. Write for our catalogue today.

THE RUTHMAN MACHINERY CO.
1818 Reading Road
Cincinnati, Ohio

MANUFACTURERS' FREE LITERATURE

To obtain, circle corresponding number on FYI page inside back cover

MACHINES AND ATTACHMENTS

1 INTERNAL GEAR SHAVING MACHINE—*National Broach & Machine Co, Detroit 13, Mich.* 8-page brochure No. S 55-4 describes Red Ring Model GCR-12 in. for spur or helical internals 3 to 12 in. PD up to 4 DP with face widths to 2½ in. Components illustrated; operational data and features described; specifications provided.

2 DEBURRING & CHAMFERING MACHINE — *Modern Industrial Engineering Co, Detroit 38, Mich.* Bulletin 103-100 describes hypoid pinion Burr-Master; production rates exceed 200 pinions per hr. Design advantages listed.

3 ENGINE LATHES—*Stokvis-Edera & Co, Port Washington, NY.* 16-page illustrated brochure contains detailed data on Demoor (Belgian) units. Close-up views of components, explanation of controls, specifications for ten models in line provided.

4 AIR-POWERED HYDRAULIC PRESSES — *Elmes Engineering Division, American Steel Foundries, Cincinnati 29, Ohio.* 8-page illustrated bulletin 1036-B provides description and specifications on Hydrolairs—small units for production work. Applications listed, operational data included.

5 LATHE CENTERS—*Ready Tool Co, Bridgeport 5, Conn.* 4-page bulletin L-55-1 gives illustrated information on Red-E anti-friction, precision units. Heavy-duty shank type, and extra-heavy-duty spindle type with double row bearings; accuracy held within less than 0.0001 total indicator reading; specifications and prices included.

6 SWEDISH LATHES & MILLING MACHINES — *Homestrand, Inc, Larchmont, NY.* 20-page illustrated catalog describes entire line of Koping units.

7 POWER TUBE-FLARER — *Parker Appliance Co, Tube & Hose Div, Cleveland 12, Ohio.* 8-page illustrated catatolg 1145A12 contains descriptive details on Parker Model 232B. Operational data for 37° or AN flaring, squaring, and burring, and beading of tubing.

8 AUTOMATIC HITCH FEED—*Producto Machine Co, Bridgeport 1, Conn.* Illustrated bulletin describes features and setup procedure for the Surefeed, in 2- and 3-in. models. Complete specifications included.

9 HEAVY-DUTY TURRET PUNCH PRESS — *Wiedemann Machine Co, Philadelphia 32, Pa.* 16-page illustrated bulletin 61 describes Model R-61 (40-ton capacity) for piercing of flat material in short run to medium production capacities.

10 GERMAN MACHINE TOOLS—*Donald C Seibert, Wilmington 99, Del.* 8-page general catalog of wide variety of machine tools made by Hahn & Kolb, Stuttgart. Description and specifications provided.

TOOLS AND ACCESSORIES

11 INSTRUMENT TOOLING STANDARDIZATION—*Von Industries, Williston Park, NY.* 24-page catalog and price list describes complete line of stainless steel jig and fixture components for instrument tooling. Included are clamps, swivel studs, jig legs and buttons, heel pins, knurled thumb screws, etc. Specifications and drawings of each unit provided.

12 SPEED & FEED CALCULATOR — *Willey's Carbide Tool Co, Detroit 1,*

Mich. Slide-type calculator has tungsten carbide grade selection scale for all ferrous and non-ferrous material; hardness conversion chart; hp correction factor scale; and grade comparison chart.

13 GAGE BLOCK ACCESSORIES — *Ellstrom Standards Division, Dearborn Gage Co, Dearborn, Mich.* 6-page brochure contains illustrated data on complete line for square and rectangular gage blocks. Accessories available in complete sets or individual pieces.

14 STUB TAP STANDARDS — *Besly-Welles Corp, Beloit, Wis.* 4-page folder gives standards recently developed by the National Screw Machine Products Association, plus details on Besly-Welles' own stub taps. Specifications, design data, illustrations and charts included.

15 DIAL INDICATORS — *Petz - Emery Inc, Pleasant Valley, NY.* 4-page bulletin 455 contains illustrated information on Em-re units available in a 24-model line, with shockproof, fully jewelled movement. Features outlined, specifications provided.

16 BALL LOCK PUNCHES — *Accurate Bushing Co, Garwood, NJ.* 4-page folder pictures and describes units made of alloy tool steel, available with varied ball sizes for regular, heavy-duty, and extra-heavy-duty services. Center pages (usable as wall chart) are chart of sizes, costs, competitive equivalents.

17 SNAPPERGAGES—*Ames Instrument Co, Concord, Mass.* Bulletin covers snap gage device which can be set to gage blocks, comparator, micrometer, for measuring outside, inside, groove spacing, hole locations, etc. Includes dimension chart for selection, and price list.

18 ALIGNMENT INSTRUMENT—*King Instrument Co, Minneapolis 2, Minn.* 4-page brochure describes composition, advantages, specifications of King-Way instrument for aligning bed-ways of lathes, grinders, shapers, boring mills, and similar machinery.

19 MECHANICAL TOOLHOLDERS — *Newcomer Products, Latrobe, Pa.* Bulletin gives illustrated data on Nu-Tool holders for use with NP carbide Throway triangular inserts. Prices and specifications included.

20 ROLL THREAD SNAP GAGES— *Pratt & Whitney, West Hartford 1, Conn.* 11-page catalog illustrates and describes units combining go and not-go gaging elements in a single lowcost gage for inspecting external threads. Applications, advantages, selection data, dimensions provided.

HEAT TREATING AND WELDING

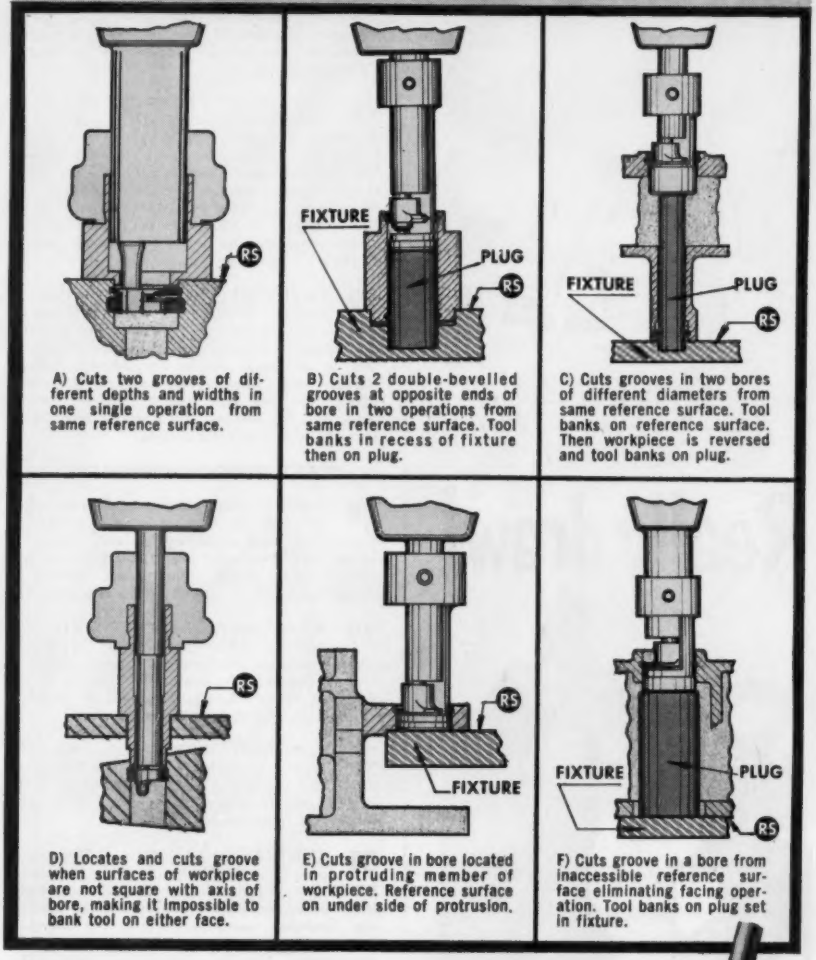
21 METAL CHILLING EQUIPMENT— *Cincinnati Sub-Zero Products, Cincinnati 29, Ohio.* 12-page catalog presents illustrated information on equipment for shrinking, testing, and treating of metals. 7 models of chilling machines and 4 testing units are described with specifications and technical data concerning applications.

22 ELECTRIC HEAT - TREATING FURNACES — *Lucifer Furnaces, Neshaminy, Pa.* 4-page brochure illustrates 6 models. Descriptional data and applications given; accessories and parts covered.

23 QUENCHING OIL — *Sun Oil Co, Philadelphia 3, Pa.* Technical bulletin 37 describes Sun Quenching Oil Light. Table shows advantages of various degrees of oil agitation; graph indicates how product compares with an expensive compounded oil.

24 UNIVERSAL SOLDERING MACHINES—*L Schuler A G, Goeppingen/Wuertt, Germany.* 8-page catalog contains illustrated data on the semi-automatic universal Model BAxu for soldering lap seams on can bodies of all shapes. Design

Even Unskilled Labor Can Use This Versatile Tool Accurately! It Simplifies Internal Grooving Problems, Cuts Production Costs!



A) Cuts two grooves of different depths and widths in one single operation from same reference surface.

B) Cuts 2 double-bevelled grooves at opposite ends of bore in two operations from same reference surface. Tool banks in recess of fixture then on plug.

C) Cuts grooves in two bores of different diameters from same reference surface. Tool banks on reference surface. Then workpiece is reversed and tool banks on plug.

D) Locates and cuts groove when surfaces of workpiece are not square with axis of bore, making it impossible to bank tool on either face.

E) Cuts groove in bore located in protruding member of workpiece. Reference surface on under side of protrusion.

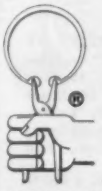
F) Cuts groove in a bore from inaccessible reference surface eliminating facing operation. Tool banks on plug set in fixture.

Amazingly versatile! Your toughest recess cutting problems can be met simply and efficiently with the Waldes Truarc Grooving Tool because it offers a whole range of possibilities beyond the range of ordinary recessing tools.

Wide Cutting Range! The Waldes Truarc Grooving Tool comes in 5 models...enabling you to cut accurate grooves in housings with diameters from .250 to 5.00 inches.

Send Your Problems to Waldes! Send us your blueprints...let Waldes Truarc Engineers give you a complete analysis, price quotation and delivery information on the most economical tool set-up for your particular job. There is no obligation!

Write NOW for a 20-page manual containing full information on Waldes Truarc Grooving Tool



WALDES TRUARC® GROOVING TOOL

Made by the Manufacturers of Waldes Truarc Retaining Rings
WALDES KOHINOOR, INC., 47-16 Austel Place, L. I. C. 1, N. Y.

Waldes Truarc Grooving Tool Manufactured Under U. S. Pat. 2,411,426

AM087

Waldes Kohinoor, Inc., 47-16 Austel Pl., L.I.C. 1, N. Y.

Please send me your new 20-page technical manual on the Waldes Truarc Grooving Tool. (GT-2-53)

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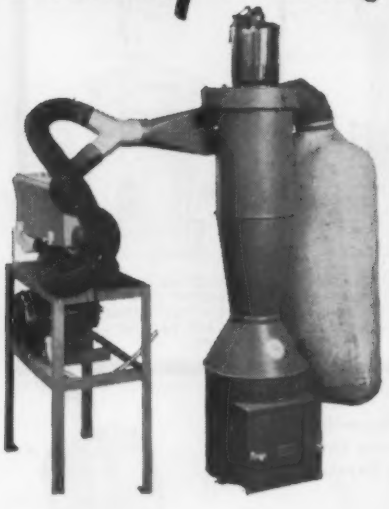
TORIT

DUST COLLECTORS

Really draw!



A size and model to solve any dust collecting problem, Torit collectors provide complete, all-around dust control. Torit collectors are unitized for custom installation on each machine, giving power and suction only when machine is operating. Keeps plant and machines free from clogging and unsightly dust. Furthermore, cleaned and filtered air is exhausted back *into* the room maintaining heat balance. Find out now how Torit unitized dust control is engineered to your problems.

See our catalog in Sweet's Machine Tool File, or write:

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and operational details, specifications, and special accessories given.

25 SILICON BRONZE & ALUMINUM BRONZE ELECTRODES — *Pacific Welding Alloys Mfg Co, Los Angeles, Calif.* Descriptive literature and price list available. Former can be used for AC or DC welding of Silicon Bronze and all Everdur alloys; applicable in all positions. Latter, for steel, malleable and cast iron, and ordinary bronzes, brasses, nickel and alloy steels, can also be used for general build-up and fabricating.

26 "GAS-FIRED FURNACES FOR INVESTMENT CASTING" — *Surface Combustion Corp, Toledo 1, Ohio.* 4-page bulletin SC-170 gives data on uniform mold heating, accurate time-temp cycles, and simple burner control. Furnace characteristics are described and illustrated. Includes chart of characteristics of typical investment casting alloys; product and application photographs.

27 LOW-TEMP WELDING ALLOYS— *Eutectic Welding Alloys Corp, Flushing 58, NY.* 4-page folder TIS 2496 shows applications for low-heat input metal joining on all base metals. Procedures, techniques, and alloy recommendations are given for cast iron repair without preheat, and for joining steels easily with extremely high joint strengths.

PLANT SERVICE EQUIPMENT

28 PUMPS—*Graymills Corp, Chicago 13, Ill.* 32-page catalog covers coolant, circulating, and agitating pumps. Variety of models available are illustrated with performance index, dimensions, descriptions, applications, construction features.

29 MATERIALS HANDLING — *International Staple & Machine Co, Herrin, Ill.* 4-page brochure illustrates properties of Vac-U-Lift device for lifting and lowering heavy objects. Applications listed, dimensions and weight given.

30 ELECTRIC TRUCK—*John Morrell Mfg Co, Elgin, Ill.* 8-page bulletin illustrates versatility of MorLift truck for lifting and moving any type of load up to 2000 lb. Applications pictured.

31 TUMBLING BARRELS — *Tumb-L-Matic, New York 70, NY.* Bulletin LS-55 describes and illustrates LS units for large scale, low-cost finishing by dry process. Includes recommendations for selecting specific abrasive compounds for various operations. Details, dimensions, optional equipment for two models provided.

32 PERMANENT MAGNETIC EQUIPMENT — *Eriez Manufacturing Co, Erie, Pa.* 6-page brochure B-207 describes complete line for conveying and controlling steel, and separating, retrieving, and purifying ferrous materials. Illustrations and specifications.

33 VIBRATION CONTROL MOUNTINGS—*Korfund Co, Long Island City 1, NY.* 4-page bulletin K4A covers 11 types; installation photos of variety of equipment; selection and performance data, engineering specifications.

34 HYDRAULIC & MECHANICAL SCOOPS—*Lewis Shepard Products, Watertown, Mass.* Circular illustrates and describes attachments for use with Spacemaster electric fork trucks.

35 "COMPARATIVE PROPERTIES OF PROTECTIVE COATINGS" — *Atlas Mineral Products, Mertztown, Pa.* 19-page report contains information on 14 types used to protect equipment, walls, beams, ceilings, where fumes and atmospheres cause corrosion. Physical, chemical, and selection data.

36 CENTRIFUGAL WET DUST COLLECTOR—*Pangborn Corp, Hagerstown, Md.* 4-page bulletin 919 contains illustrated description of type CW-1 counter-current wet collector of tower construc-

PRECISE MULTIPLE CUTTING...WITH ONE W&S TOOL cuts your production costs

Holes within holes—holes of multiple diameter, intricate profile, and great precision—can be bored in a single operation with a Woodruff & Stokes small cutting tool designed by specialists for your exact requirements. Holes from pin-point to ½" diameter—single or concentric, tapped or reamed, bottomed or through-cut—are made quickly and economically in the hardest metals with W&S tools.

If your production involves the precision machining of very small holes, let Woodruff & Stokes design into one operation a job that may now be costing you as many as five.

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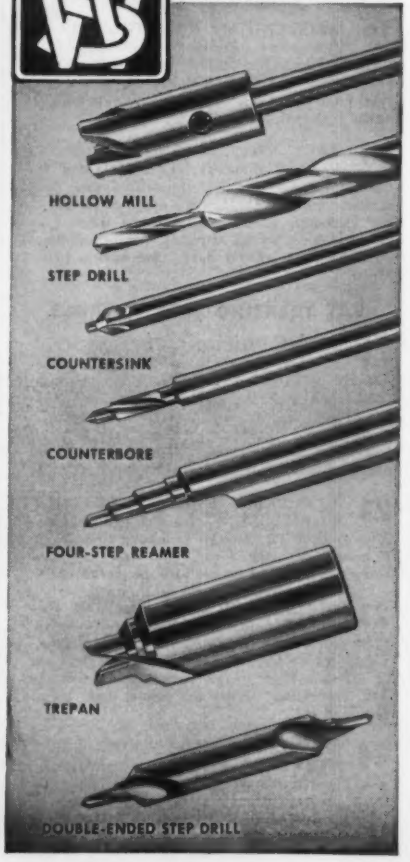
Some W&S Tools ACTUAL SIZE



tion for control of explosive, corrosive, abrasive, or obnoxious dusts.

37 CURRENT CONTROLLERS—*Conoflow Corp, Philadelphia 3, Pa.* 4-page bulletin EB-1 describes Model EB pneumatic-electric transducer which provides automatic control of current input. Operating features and applications illustrated.

PARTS AND MATERIALS

38 FLUID DRIVES—*American Blower Corp, Detroit 32, Mich.* 8-page illustrated catalog and selection guide No. 9419-9519 describes Type VS Class 2 Gyrol drive for general purpose applications. Advantages, construction features, operational and selection data included.

39 BRONZE GLOBE VALVE—*Lunkenheimer Co, Cincinnati 14, Ohio.* 4-page illustrated circular describes LQ600 valve with Brinalloy seats and disks, said to be extremely wear and corrosion-resistant.

40 STRAIGHT LINE & RIGHT ANGLE SPEED REDUCERS — *Foote Bros Gear & Machine Corp, Chicago 9, Ill.* 40-page illustrated engineering manual LP 3 presents detailed information on Line-O-Power units. Advantages, features, construction, applications, characteristics, tabular data included.

41 PHENOLICS IN PLASTIC TOOLING—*Rezolin, Inc, Los Angeles 45, Calif.* 6-page illustrated brochure covers R-72S Phenolic Tool-plastik; gives applications, properties, characteristics, handling instructions; flow chart demonstrates typical fabrication procedure.

42 ROLLER BEARINGS—*Hyatt Bearings Division, General Motors Corp, Harrison, NJ.* 68-page illustrated catalog 150 gives dimensions, load ratings, application data on solid roller, solid race, split race, industrial inch bearings.

43 HIGH-STRENGTH STEELS — *Republic Steel Corp, Cleveland 27, Ohio.* Form ADV-668 gives data for cold forming, rolling limits, and applications on "50" High-Strength Steel. Second folder, Form ADV-667, contains similar information on "65" and "70" High-Strength Alloy Steels.

44 MECHANICAL SEAL — *Garlock Packing Co, Palmyra, NY.* 8-page illustrated bulletin AD-150 contains charts, diagrams, dimensions, applications of BB-21A Mechanipak seal for use on rotary shafts at pressures up to 150 psi.

45 FILTERS—*Marvel Engineering Co, Chicago, Ill.* 10-page catalog 106 pictures and describes Synclinal filters for hydraulic oils, coolants, and lubricants. Dimensional and engineering data in chart form; mesh sizes illustrated.

46 PHOTOELECTRIC CONTROLS — *Photoswitch Division, Electronics Corp of America, Cambridge 42, Mass.* 20-page illustrated pamphlet "Proved Answers to Successful Automation" contains specifications, descriptive data, operational charts of controls for high-speed counting, inspection and sorting, high-temp measurement and control, machinery safeguards, etc.

47 VARI-PITCH SHEAVES — *Allis-Chalmers Manufacturing Co, Milwaukee 1, Wis.* 4-page illustrated bulletin 20B6082C describes stationary and motion control sheaves for speed variations up to 76% by means of PD adjustment, capacities 1 to 600 hp. Includes table of sizes and general dimensions.

48 CONSTANT-FORCE SPRING — *Hunter Spring Co, Engineering Dept, Lansdale, Pa.* 16-page illustrated bulletin 310N describes 25 design applications of the Neg'ator spring, and its uses in many

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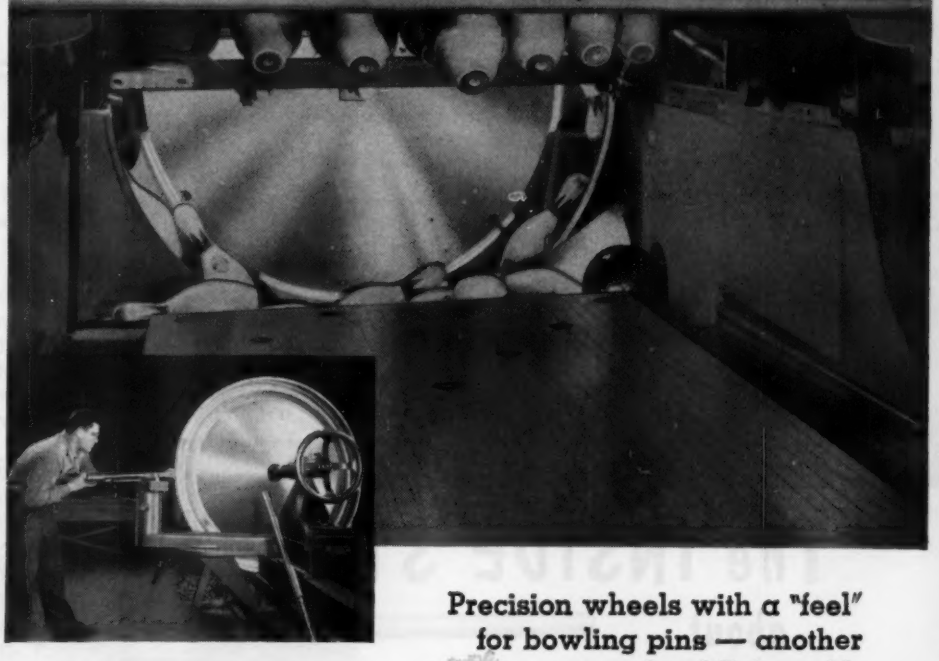
Spincraft can do it for you!



NINE DIFFERENT OPERATIONS—
Spinning and forming tolerances to .031"

On each 5-ft. wheel, Spincraft assumed 100% fabricating responsibility: deep draw, spin, punch, blank, stamp and form, pantograph (chamfer), surface finish, drill, rivet, carton and ship. Operator (above) is spinning the ⅛-in. thick sheet of tough 52S aluminum alloy. Cross-section of basic wheel (right) shows unusual contour requirements. Raised segments are ⅛-in. cold rolled steel.

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Precision wheels with a "feel" for bowling pins — another example of Spincraft's fabricating skill

By setting pins faster, American Machine and Foundry's automatic pin spotter gives more bowlers more opportunities for better scores! Spincraft is proud to have successfully fabricated a key component of the AMF pin spotter. It's the large-diameter pin elevator wheel — our solution to a difficult production problem for this well-known manufacturer.

This is *one more* example of Spincraft's versatility, capacity and skill. We offer complete facilities for contract manufacture of metal parts or complete units. No jobs are too big — or too small. One piece or millions are taken in stride.

Engage the facilities of the world's largest metal spinning plant — the only such plant also equipped for deep drawing, stamping and complete fabrication. You'll get results and savings that far exceed your expectations!

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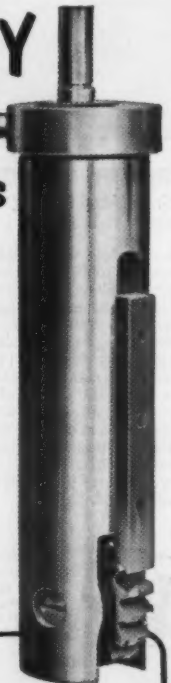
The INSIDE STORY about NATIONAL Keyseating Millers



NATIONAL Keyseating Millers are designed for milling internal keyseats . . . in one cut . . . in offset holes . . . with parallel sides . . . partly through holes . . . of standard width and depth . . . in holes that are closed at one end . . . and many other operations that a keyseating machine can't reach. A demountable guide on body of Miller enters keyseat being milled assuring straight keyseat in perfect alignment with the axis of the bore, thus making it unnecessary to clamp work to drill press table.

CUTTERS are made from high speed Rockwell hardened steel, accurately ground to size. Tops of teeth are staggered to break chips which reduces strain and wear on both cutter and driving pins. It will pay you to put National Keyseating Millers on the inside of your next keyseating job.

national MACHINE TOOL CO. CINCINNATI 22, OHIO

WRITE TODAY for Catalog No. 17 complete, handy size

mechanical-loading and power-drive problems.

49 ALUMINUM ALLOY SHEET — *Kaiser Aluminum & Chemical Sales, Inc, Industrial Service Div, Oakland 12, Calif.* Wall chart gives weight and bend data on sheet in standard alloys; weight per sq ft; weight per sheet in standard sizes; and approximate radii for 90° cold bends in various gages, alloys, and tempers.

50 "DESIGN MANUAL FOR HIGH-STRENGTH STEELS" — *US Steel Corp, Pittsburgh, Pa.* Booklet ADVL-215-54 contains technical information, charts and formulas, not only for high-strength, low-alloy steels, but also for structural carbon steel; can be used as a multi-purpose design manual.

ROUND TABLE Discussion

REFORMED OR DEFAMED

Should a man be suspect because he has served a term in prison? Is it logical for his co-workers to resent his presence, particularly if he has returned to the shop where he committed his original offence?

If no one ever gave a man a second chance, then this world of ours would certainly be a place without industry.

This would include the day when we spoiled the production die because we were not paying strict enough attention to our job. Yes, we were to blame, but we passed it off by blaming the engineering department. The boss knew we didn't actually have a leg to stand on, but he pretended to believe our story and let us keep the job. Wasn't that a second chance, or maybe even the third, or fourth chance? Sure it was. True enough, you didn't try to make any ten-dollar bills but what made you try to get out of it anyway? Something prevented your being

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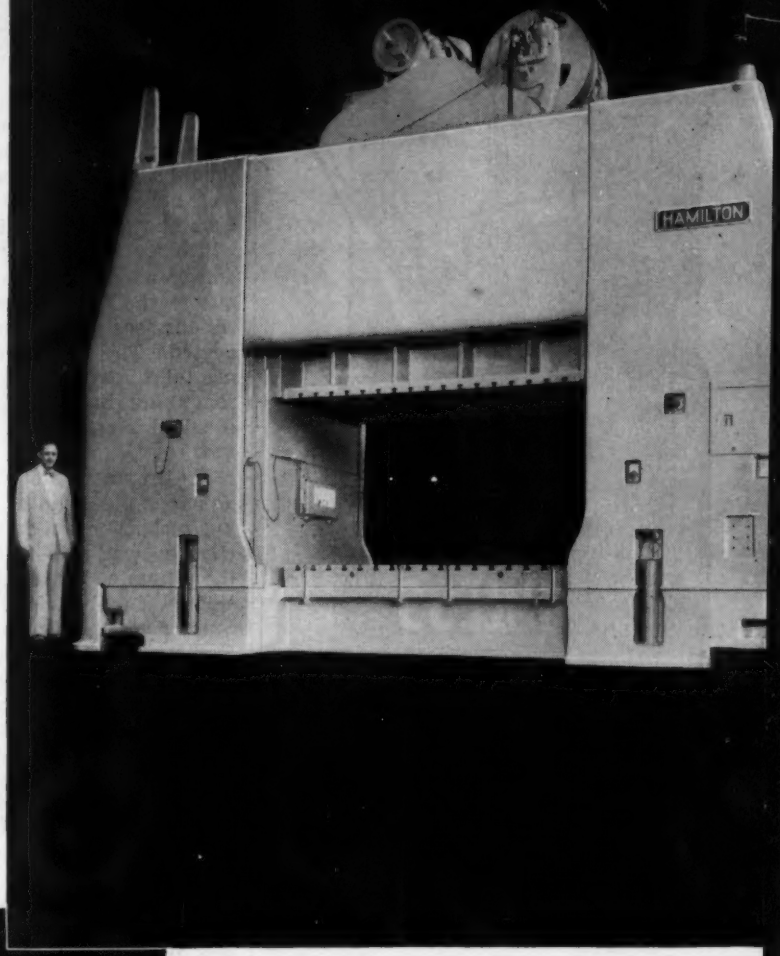
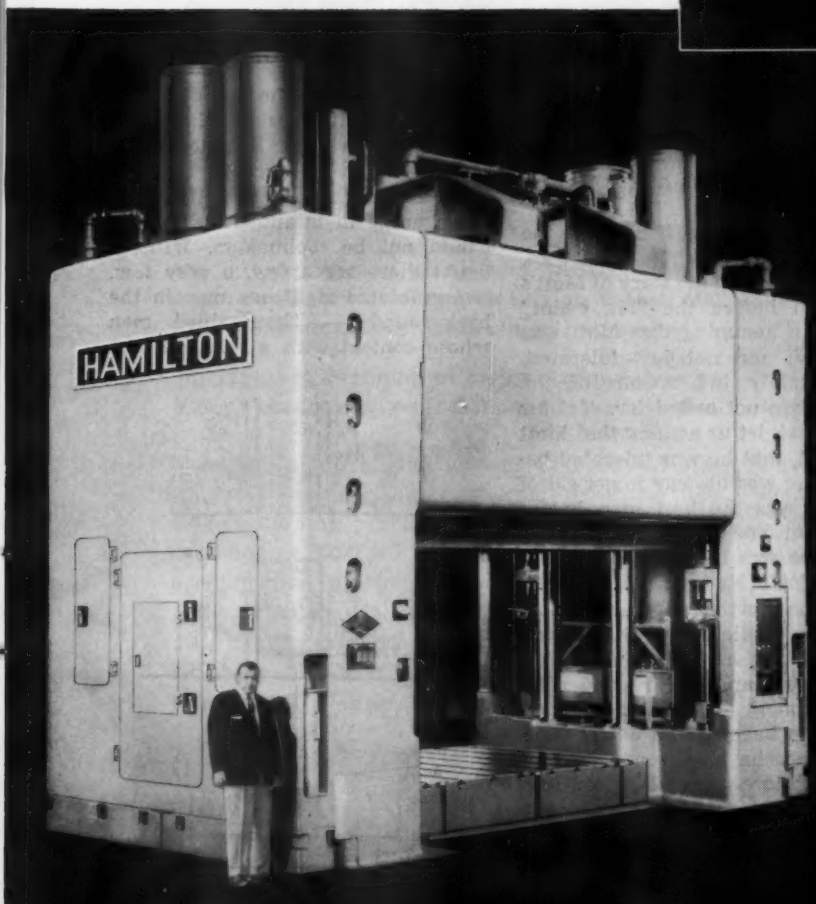
Now you can increase your productive capacity without delay. These Hamilton presses are in stock, as well as other single action, double action and triple action presses.

Hamilton's new unique policy of building these standard presses for stock means a sound investment for you. You'll profit by acting right away.





Like to get details on these available presses? Just pick up your phone and call Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.

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Hamilton Division

BALDWIN-LIMA-HAMILTON

8 tons of power!

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Bending
Curling
Box Forming
Corrugating
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Blanking
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Flattening

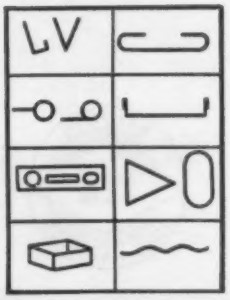
NEW DI-ACRO* PRESS BRAKE

Eliminate tie-up of a large press brake on short-run production jobs with the new Di-Acro Press Brake. It's quickly set up for experimental engineering, too. Hand operated—ample power is provided for average use by a simple cam lever mechanism, plus a power multiplying ratchet drive for heavy forming jobs.

New Di-Acro Press Brake forms 16 gauge mild sheet steel across the full 24" forming width, 10 gauge mild sheet steel across a 12" width as well as other ductile materials. Available with standard dies and specials—both are interchangeable with other press brakes.

See 2 Di-Acro Exhibits at Chicago Sept. 6-16; Production Eng. Show, BOOTH 125-126, Navy Pier. Metalworking Show, BOOTH 653, Chicago Coliseum.

Diagrams Show Di-Acro Press Brake Operations.



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Send for 32 page catalog . . . contains complete information on Di-Acro hand and power operated Benders, Brakes, Notchers, Punch Presses, Rod Parters, Rollers, Shears, Spring Winders.

di-acro PRECISION METALWORKING MACHINES

*Pronounced Die-ack-ro

O'NEIL-IRWIN MFG. CO.
311 8th Ave.
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fully honest about it. Actually, we cannot condemn the other fellow for these acts unless we judge ourselves in the same light.

It is a natural feeling that once a thief, always a thief, or that a man with a prison record deserved it and should stay there forever. Yet many men have had mental lapses which have been caused by conditions which we have never been able to determine, but which have caused queer (shall we say) actions. These actions are oftentimes never repeated. They are corected, or the mental obstruction is removed by something happening, and the individual is once again a normal person.

So the man Mott strayed once, and tried his hand at making printing plates for ten-dollar bills. Perhaps he was only trying to achieve the ultimate. If his talents had been steered in the right direction he could, no doubt, have become famous. Perhaps with a second chance and the guidance that was denied him in his earlier work, he can become one of those who contributes worthily to society. Wouldn't it be a satisfaction to your company to say "I helped to give George Mott his second chance . . . the chance to become the best engraver this company ever had."

There is a satisfaction in a job well done that will be denied those who are unwilling to assist in giving others a second chance, or make an effort to help those who have lost their way. There is a vast difference between the person who has momentarily strayed, and the hardened criminal.

The toolroom gang, if we have the story right, is making a mistake. That is, if we have the story of Mott's association before the "big event" correct. In assuming that Mott was well liked, and not just tolerated, then certainly the actions of the toolroom are not called for. Yet for the moment, let us assume that Mott did not fit, that he was tolerated because there was no way to get rid of him. He was the best man in the department and they resented him because he was better than average on his job. He usually got the breaks—he was that good—and could efficiently handle the work. He was, moreover, not a good mixer. Now the picture changes. No wonder the toolroom gang finds this a wonderful way to keep a man out of their lives. Since he has been gone they have had more glory. Possibly they even helped to cause Mott's downfall. Workers who desire to remove obstructions will sometimes go to extreme lengths to accomplish their ends.

Better study all conditions before making a decision. Facts will tell the true story. Then if you find Mott cannot work harmoniously with the gang—not because of himself, but because of the petty, jealous feeling of small men, then don't take him back. The trouble will never be stopped if you do.

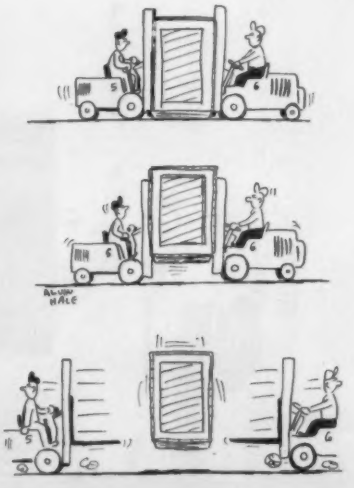
Hard on Mott? Yes, but he can be helped if you will do something toward finding him a new job—perhaps elsewhere within your own company, or with some other company.

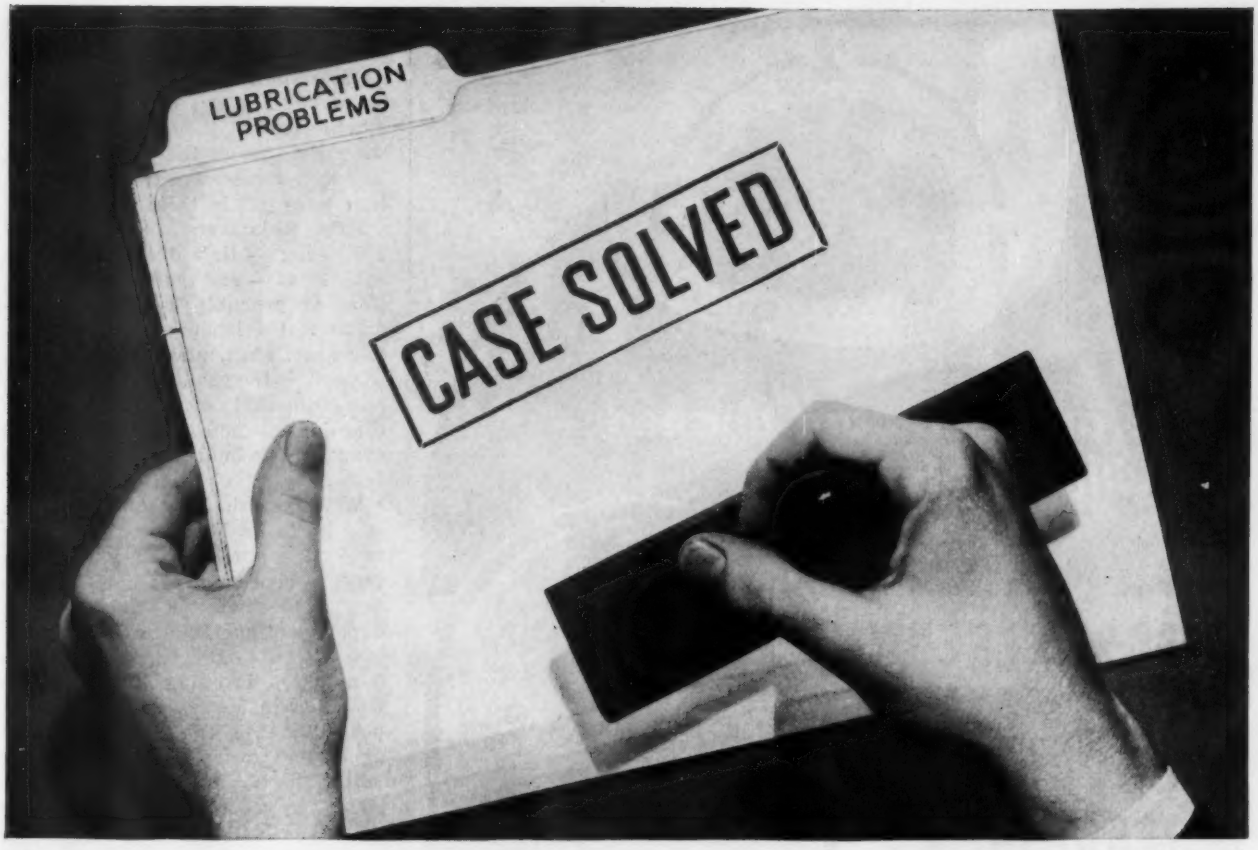
However, if the toolroom gang always got along with Mott, and were friendly toward him, and they are objecting to his return, better find out the reason why, and then make an effort to correct the thinking of your workers. Perhaps they are only reflecting your own thinking. Better check up.

You, as foreman, are a leader of men and now is the time to test yourself. Be sure of your own desires and then act. If all facts are known about an ex-con, no danger will come in helping him to regain his place in society. Many companies have done so and have produced good records of accomplishments, both for the ex-con and also for the company's ability to handle men.

Charles D Townsend
West Hartford, Conn

"There, But For The Grace of God, Go I" should be written in large letters on the wall of Ed's toolroom. Mob rule has apparently taken a grip on men who are generally above the average in intelligence, or they would not be toolmakers. Without doubt there are a few, a very few, self-annointed righteous men in the background — "honorable" men whose contact with a released con-





Vilter Mfg. Co. Solves 3 problems with Cities Service Lubricants

PROBLEM 1. Formation of carbon on air compressor valves, necessitating shut-down to clean every three months.

PROBLEM 2. Mixing of oil and water on valve gears and bearings of engine driving Vilter's 600 KWH generator. Constant draining required.

PROBLEM 3. Groaning of corliss steam valves on Vilter's condensing, cross-compound steam engine.

Since 1867, Vilter Manufacturing Company of Milwaukee has enjoyed the reputation of solving difficult engineering problems in refrigeration and air-conditioning. So it was natural that when Vilter had a lubrication problem, it would solve that also. Natural, too, that Cities Service Lubricants would be those chosen to carry out the task.

Says Vilter's Chief Power Plant Engineer, James Murphy: "The valves on our two-stage, high pressure air compressor were coating with carbon so badly that we had to shut down and clean them every three months. Then we switched to Cities Service DC-300 Oil. Now, after nine months, valves are perfectly clean and our carbon problem is gone.

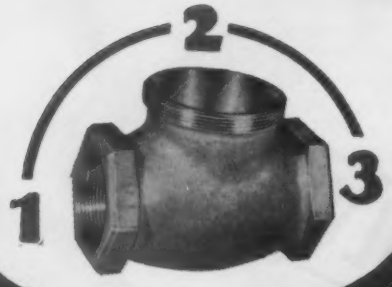
"At the same time we tried Cities Service Pacemaker No. 3 to stop a problem of oil mixing with water on the valve gears and bearings of the steam engine driving our 600 Kilowatt hour generator. The problem ceased and for more than nine months we haven't had to change the oil because it does not emulsify with water.

"We also silenced groaning from the corliss steam valves of this steam engine by switching to Cities Service Optimus No. 3."

If you have a lubrication problem talk to a Cities Service Lubrication Engineer. Chances are he can solve it. Or write: Cities Service Oil Company, Sixty Wall Tower, New York 5, N. Y.

CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

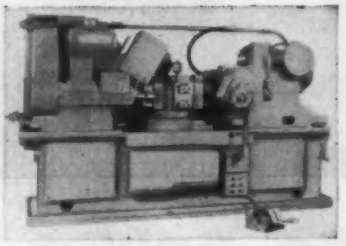


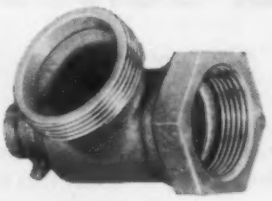
...and parts are finished without rehandling on

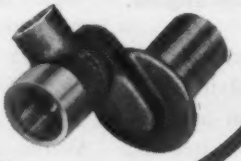
GOSS & DeLEEUW AUTOMATIC CHUCKING MACHINES

The Goss & DeLeeuw "One-Two-Three" Chucker differs from the conventional machine in that it provides the means of machining more than one end of a piece in a single handling instead of requiring several handlings and set-ups. A worthwhile gain in production time is assured.

In the "1-2-3", work is gripped in chuck and all ends machined either in sequence or simultaneously. Goss & DeLeeuw and only Goss & DeLeeuw offers this feature in a standard chucking machine.







A few typical parts finished on this machine are shown here. Write for detailed description . . . send samples of your work for time and cost estimates.

GOSS & DeLEEUW
QUALITY PRODUCT-QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

victict might besmirch their established standing in the community. But how do they know what is right and what is wrong? How do they know whether or not they would keep on the right side of the thin uncertain line that divides the two, if temptation were put in their path?

Ed's toolmakers are afraid of something — they do not know exactly what — and their herd instinct, prodded probably by some not-so-disinterested leaders, flares into intolerance. Mott, now different from the rest, is the goat. Otherwise, these run-of-the-mill men would realize that their passions have carried them away, and would stop to listen to reason.

Would not the best solution in this case be to let Mott wait a week or two, on a nominal salary if necessary, to give emotions time to settle down? Meanwhile let the personnel department and Ed discuss the problem with the more reasonable of the toolmakers, bringing to their attention that in Mott they may have a peril, but it is one that they know about and can act on accordingly, while there may be in their surroundings other hidden perils? How do they know that TB or even VD carriers do not associate daily with them?

Pierre P Fenaux
Lynn, Mass

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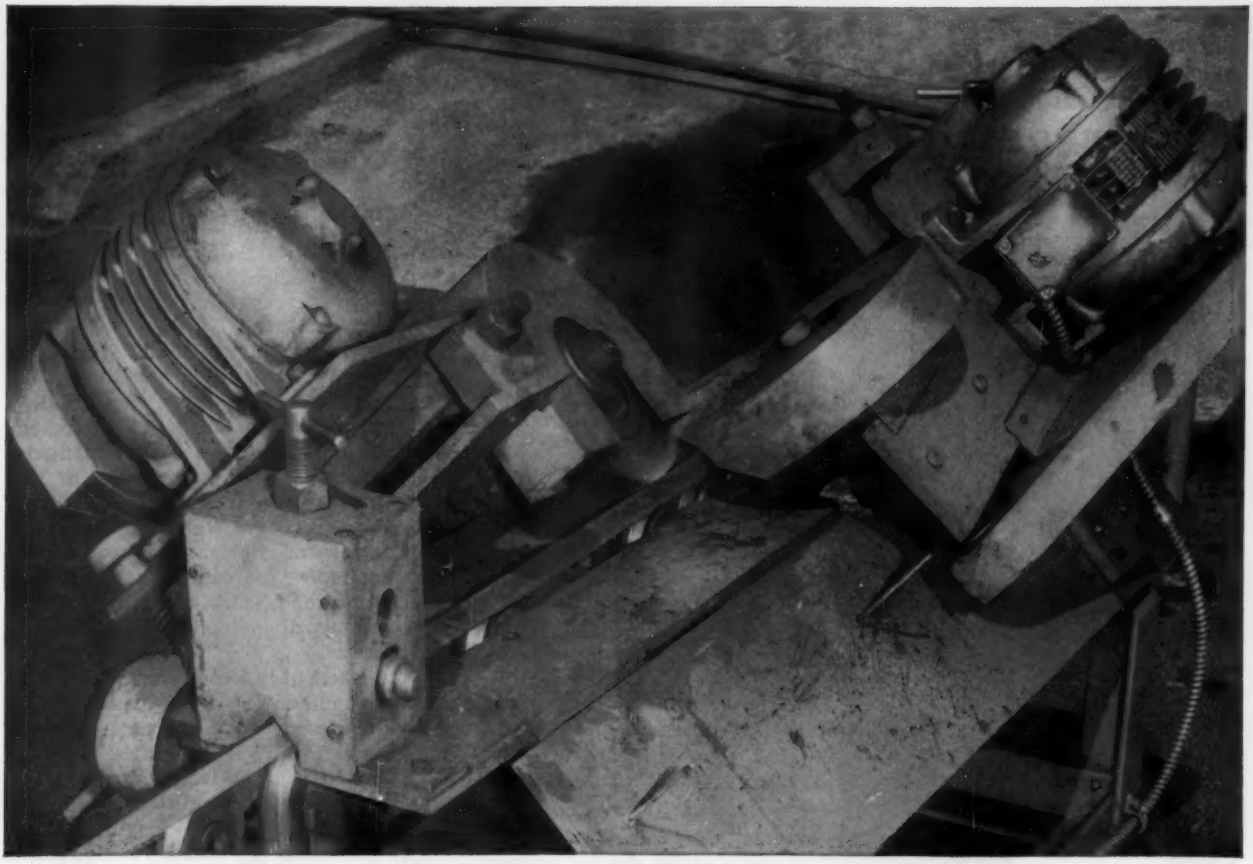
New Books . . .

QUALITY CONTROL—*By Norbert L Enrick. Second Edition. Published by the Industrial Press, 148 Lafayette St, New York 13. 181 pages, 6 x 9 in. Price, $4.*

Statistical quality control can, of course, be a very complicated subject, requiring the use of advanced mathematics. This book tries hard to avoid the complexity of the math, yet includes all that is necessary to put the quality control into operation. The result is that the practitioner of the art (science?) is forced to accept a lot of what he is doing more or less on faith. He is also limited in what he can do with the technique, because if his needs are not filled by the "do-it-yourself" nature of the text, he does not have the tools to figure a way around the trouble.

Nevertheless, this is probably a useful book for those who would like to replace screening (100% inspection) with one of the less-laborious sampling techniques.

The revision for the second edition



FAST PASS STRIPS SCALE

to save money on material!

A cost-reducing idea an OBA can duplicate in your plant

This manufacturer takes advantage of a price differential by buying a grade of angle iron that still has mill scale on it.

The Problem: How to remove this hard scale and still save money over purchasing a more costly grade of steel that has been pickled.

Here's what they do: The angle iron bars are fed through a simple brushing machine against two Osborn Master® Wheel power brushes. In one pass, these Osborn Brushes effectively remove the hard, flint-like scale . . . at a rate of 150 feet a minute.

The strips come clean, ready for production.

You benefit many ways by having an **O**sborn **B**rushing **A**nalysis made of your cleaning and finishing operations. You can improve the quality of your product, automate your methods and cut manufacturing costs. Write us about an **OBA.** *The Osborn Manufacturing Company, Dept. C-35, 5401 Hamilton Ave., Cleveland 14, Ohio.*

BEFORE BRUSHING
Steel strips are covered with hard mill scale.
AFTER BRUSHING
Scale is gone. Surface is clean, ready for use.

Osborn Brushes

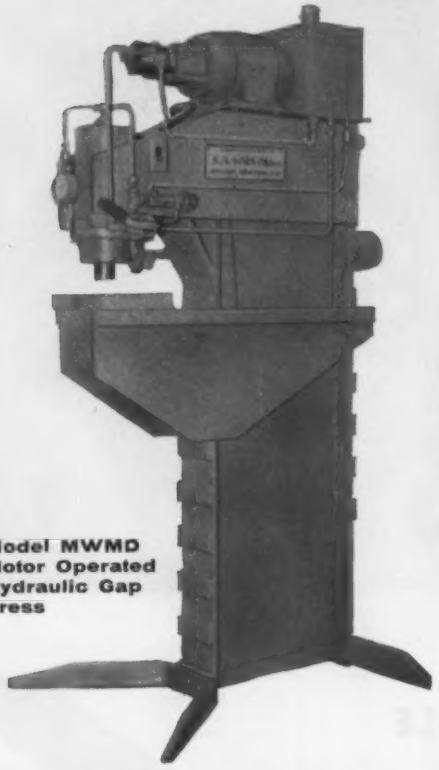
OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

See this press at Booth 114 Chicago Coliseum Machinery Show.

NOTICE!

A REVOLUTIONARY NEW CONCEPT USED IN THE DESIGN OF THESE PRESSES. ALL OTHER FIXED BED MECHANICAL PRESSES NOW OBSOLETE!



Model MWMD Motor Operated Hydraulic Gap Press

Model MWAO Hand-Air-Oil Operated Hydraulic Gap Press

*U. S. Patents Pending and Applied for.

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We mean it. The amazing new K. R. Wilson Adjustable Gap Presses have set a new standard in versatility of operation and money saving efficiency. Here's the story.

- **Complete Versatility.** Handles bending, straightening, pressing and forming jobs in either maintenance or production. Fastest set-ups possible.
- **Press adjusts to the work on all jobs.** Easy, hand-operated geared winch moves bed from 4" to 30" daylight (with ram up) at 6" increments.
- **Exclusive K. R. Wilson TILT-LOCK* system** holds bed securely in each position. No extra adjustments needed.
- **Fast action – no lost motion or labor.** Ram lowers to work with cylinder preloaded ready to apply pressure immediately.
- **15 and 25 ton capacities** available in hand-air-oil or power-driven models. Choose from 8 standard models or have K. R. Wilson's engineers modify to your particular requirements.
- **And low in cost!** These fully hydraulic presses, with adjustable bed, cost no more than ordinary fixed bed mechanical presses.

These are the facts, now get the details on K. R. Wilson's amazing Adjustable Bed Gap Presses. WRITE FOR BULLETIN No. 79 TODAY!

K. R. WILSON, Inc.
HYDRAULICS DIVISION
202 MILL ST. ARCADE, NEW YORK, U.S.A.

adds information on certain types of charts which give more flexibility to the kind of limits that can be imposed on acceptability, such as multiple-control charts, control charts within tolerance limits, and so on.

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COST ACCOUNTING—*By Clarence B Nickerson, professor of accounting, Graduate School of Business Administration, Harvard University. Published by the McGraw-Hill Book Co, 330 W 42nd St, New York 36. 462 pages, 6 x 9 in. Price, $7.*

Here is another in the series of Harvard Problem Books, which treat a subject with the "case method," rather than a simple series of lectures. When teaching cost accounting, this seems like an excellent way to present information, because each company's manner of gathering and recording costs is different, and any "standard" method would be unrealistic.

Users of this book should be aware that either extensive experience or the presence of an instructor is necessary. Problems are stated, and the student is often left to work out answers from bare outlines of information.

Coverage is broad, ranging from the habits of a one-man company making drills, reamers, and other cutting tools to the actual selling methods of the textile industry. A good indication is given of how one industry differs from another, and how company size leads to different accounting policies.

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New Films . . .

YOU ARE THERE AT THE BARGAINING TABLE: COLLECTIVE BARGAINING IN ACTION. *Produced by American Management Ass'n, 330 W 42nd St, New York 36, NY. 16 mm, black and white, sound. Running time 50 min. Rent or purchase.*

This is a milestone that may well mark the beginning of a new era in public information and labor-management relations. It is based on a closed-circuit telecast of part of the 1955 contract talks between Rogers Corp and the International Brotherhood of Paper Makers (AFL).

Completely unrehearsed, it shows a session in which company and union representatives bargain over wage rates, fringe benefits, and incentive pay. A spoken commentary from time to time calls attention to tactics used by both sides and the

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Whatever your metal-cutting needs, Disston "know-how" will give you better cutting, longer tool life, more value for your tool dollars.

For example, the new Disston Roll-Chip Buttress-Tooth Metal Cutting Band Saw incorporates a new and stronger tooth design with a wide, non-clogging gullet. It makes possible heavier work loads. It "cuts cool," lasts longer and gives smooth finish. It is excellent for removing gates and fins from aluminum and magnesium castings and other non-ferrous metals.

In Disston files the exclusive Bite-Rite® tooth design means faster, smoother, easier cutting. The wavy teeth form curls instead of chips—thus assuring clean, open gullets. They are available in American or Swiss Pattern types for every filing need—from large castings to small intricate shapes.

The new Super-Safe Hack Saw Blades are the safest blades you can buy. With long-life high-speed-steel cutting edges on tough, shatterproof alloy-steel backs, they absorb heavy strains, will not shatter. Depend on Disston for better hack saw blades and frames, metal-cutting band saws, all types of files and circular saws.

Call your Disston distributor today and have him demonstrate these tools right in your shop. On your own machines you will see for yourself why Disston quality means more efficient, more dependable metal-cutting.

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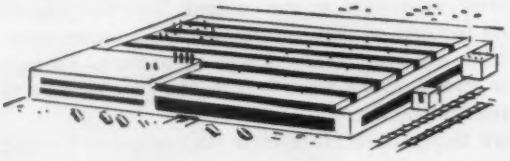

If you are faced with the problem of producing machines or parts for which your own equipment is not entirely adequate, you'll find Crown a reliable source for this kind of work. As one of the leading manufacturers of machinery for the soft drink, brewing and dairy industries, Crown has extensive machine shop facilities and a wealth of experience in producing precision parts and assemblies of the highest order. Let us show you how our plant and organization can serve you.

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collective bargaining principles they illustrate.

For companies that want to use the film for training purposes, there is a 125-page kit containing suggestions for staging a film conference, and factual background material on collective bargaining. Also included are an AMA report on current issues in labor relations, an analysis of major contract clauses, and special articles and exhibits on such topics as making a wage survey and communicating with employees during bargaining.

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Names in the News . . .

Rudolph Furrer, vice president of ACF Industries, Inc, formerly in charge of the Nuclear Energy & Special Products Division, has been made vice president in charge of manufacturing and engineering of the parent company. In addition, he has been named president of the NEP Division.

Steve Jerome has been appointed general manager of Wagner Brothers Equipment Co, Detroit manufacturer of plating and finishing equipment.

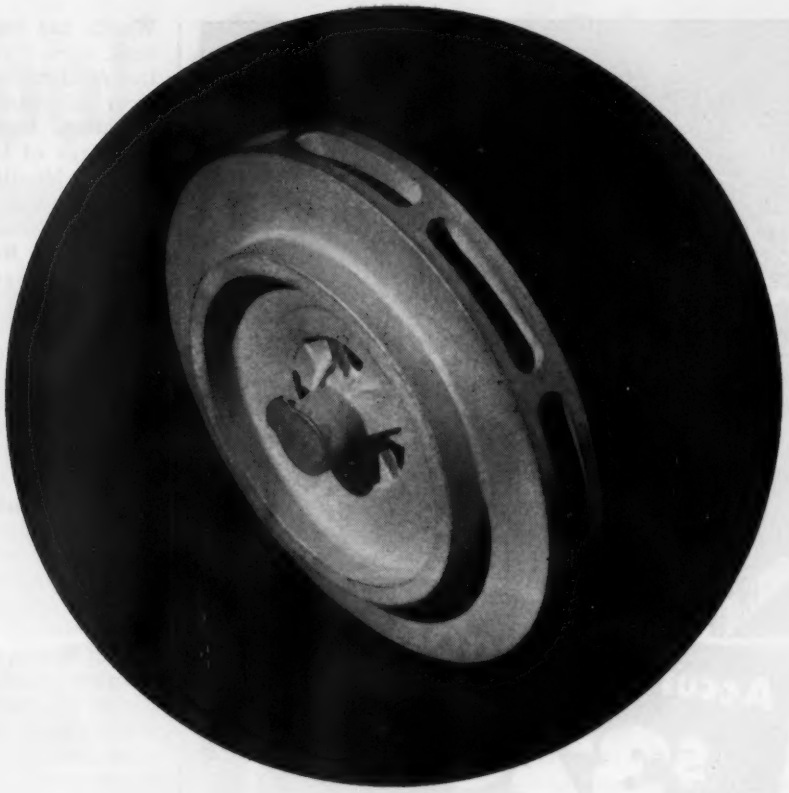
Frank W Glaser, formerly vice president in charge of research and development for the American Electrometal Corp, Yonkers, NY, has been appointed vice president and director of the Alloy Precision Castings Co, Cleveland, Ohio.

Vincent P Reinfeld, formerly associated with Executive Services, Cleveland, Ohio, management consultants, has been named president of Pyrosil, Inc, industrial electroplating equipment manufacturers of Cuyahoga Falls, Ohio.

H D McLeese, vice president and general sales manager of United Chromium Incorporated, a subsidiary of Metal & Thermit Corp, New York, has been named general sales manager of both companies. **Dr J E Stareck** has been appointed director of research of the parent company and the subsidiary.

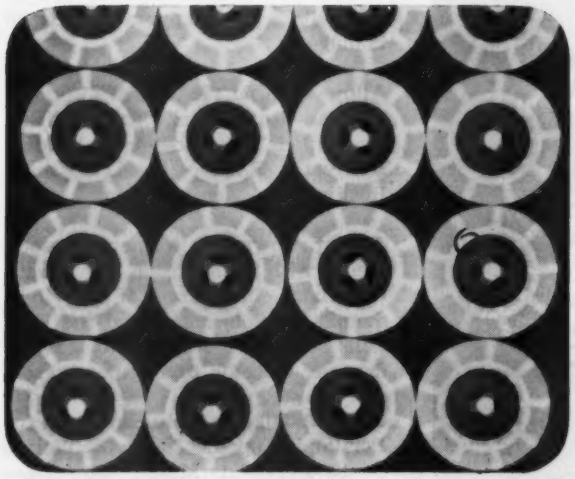
Francis L Dabney, assistant secretary and treasurer of The Bullard Co, has been elected a director of the company.

Don Parkin, formerly aircraft sales manager for Taylor Forge & Pipe



SPINS LIKE "BLAZES"—

so Radiography checks each one



Radiograph of oil scavenger rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the maker's shorter expression for the rate at which this rotor spins. Fact is, rpms are so high that the soundness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving soundness with x-rays has become common practice with more and more suppliers of quality castings. They know it helps build reputations for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Radiography...

another important example of Photography at Work

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Quality and precision have not been compromised in this undertaking. Ask those who use them. Write for literature.
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LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

Works, has been named vice president, sales, for O & M Machine Co, Los Angeles designer and manufacturer of airborne equipment. **Tom Davidson,** formerly vice president in charge of Union Steel Co's Aircraft & Missile Divs, has been appointed O & M sales manager.

Norbert K Koebel has been appointed manager of the Heat Treating Furnace Division, Lindberg Engineering Co.

Malcolm Roberts, formerly associated with Kurt Orban Co, has been named manager of Leland-Gifford Co's Cleveland sales district.

J Walter Gulliksen, general manager of the Waterbury Mfg Co Division of Chase Brass & Copper Co, has been elected divisional vice president.

Robert Krogh, district sales manager in Ipsen Industries' Detroit and Cincinnati territories, has been appointed sales manager for the company, Rockford, Ill, manufacturer of heat-treating equipment.

Admiral Alan G Kirk, chairman of the board and president of the Mercast Corp, New York, has also been elected president of Alloy Precision Castings Co, Cleveland, following the resignation of **Ronald D Gumbert.** Admiral Kirk will continue to serve as board chairman of Alloy, a subsidiary of Mercast. **Frank W Glaser,** vice president of Alloy, has, in addition, been appointed general manager.

Alloy Casting Institute elections: **Thomas Rutherford,** The Midvale Co, Philadelphia, president; **Bradley B Evans,** Empire Steel Castings, Reading, Pa, vice president.

Arthur Townhill, formerly associated with Thompson Products, Cleveland, in charge of the light metals division, has joined the Harwill Corp, Los Angeles die-casting firm, as director of engineering.

Harry J Higgins, sales engineer for Portland Copper & Tank Works, South Portland, Maine, fabricators of stainless steel and super alloys, has been appointed sales manager of the company.

John T Page, assistant general manager of Cascade Manufacturing Co, Portland, Ore, manufacturer of hydraulic cylinders, has been appointed general manager and a board member.

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

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2 Fine Tool Steels Team Up to Make Compound Die

This compound blanking, forming and piercing die is used by National Motor Bearing Co., Redwood City, Calif., in the production of cup cases for oil seals. The die is made up of two grades of Bethlehem tool steel: BTR and Lehigh H.

Hardened to Rockwell C 60-61, the long-wearing die forms the cup cases from plain carbon steel, stainless steel, and brass sheets. They range in diameter from ½ in. to 14 in., and in thickness from 0.030 in. to 0.090 in. The die produces parts to tolerances of plus or minus 0.002 in., and produces up to 75,000 pieces before slight redressing is required.

BTR (Bethlehem Tool Room) is our general-purpose, manganese-chromium-tungsten grade of oil-hardening tool steel. Its main feature is its safe-hardening property. This, coupled with its sound combination of wear-resistance and toughness, makes BTR an ideal steel for all general-purpose tool and die applications.

Lehigh H is a high-carbon, high-chromium tool steel. It offers maximum wear and minimum distortion in heat-treatment. It is also a deep-hardening steel, in air, and thus has high compressive strength.

Your tool steel distributor will be pleased to furnish additional information about these fine Bethlehem tool steels. He'll welcome your call, right now.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Why and How to Stress-Relieve Tools

Stress-relieving is performed on tools to partially remove residual stresses resulting from machine work, mechanical straightening, hobbing, or other cold working. The reduction of stress is important in avoiding excessive distortion during tool hardening, as well as in avoiding the cracking that results from the addition of residual stress to the thermal stress produced when heating to the hardening temperature.

Stress-relieving is accomplished by heating the steel to from 1100 to 1300 F. Because of the relatively low temperature, surface protection against scale or decarburization is usually not required. As the temperature used is always below the transformation range of the steel, the rate of cooling is unimportant, except that it must not introduce thermal stress during cooling. Only a portion of residual stress is removed by this procedure. Up to the lower critical, the higher the stress-relieving temperature, the more completely is the stress removed.

The degree of stress-relief afforded in this manner is usually sufficient. However, if complete relief of stress is required, a full anneal practice should be employed, including full austenitization and slow furnace-cooling.

TUBE MANDREL FOR SERVICE IN EXTRUSION PLANT

Shown during a finishing cut, this tube mandrel will see service in the extrusion plant of Kaiser Aluminum & Chemical Corp., Halethorpe, Md. The mandrel is made of Bethlehem Cr-Mo-W (chrome-moly-tungsten) tool steel. Cr-Mo-W is an all-around hot-work steel containing 5 pct chromium. It is especially suited for jobs that involve shock and drastic temperature changes, as well as for jobs where heat-checking is a problem.

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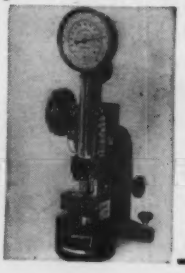

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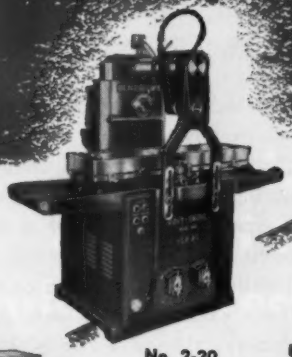

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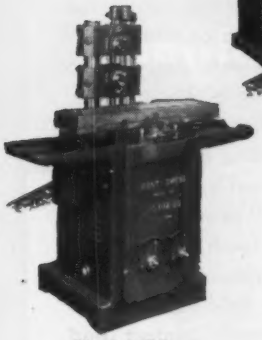

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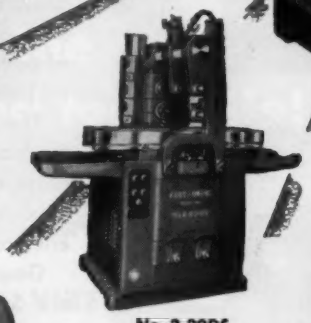

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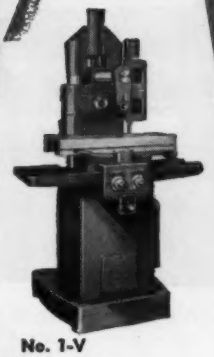

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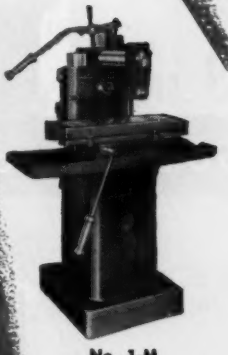

No. 1-M
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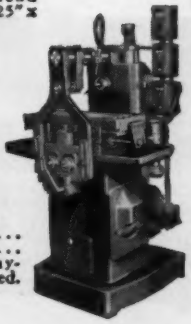

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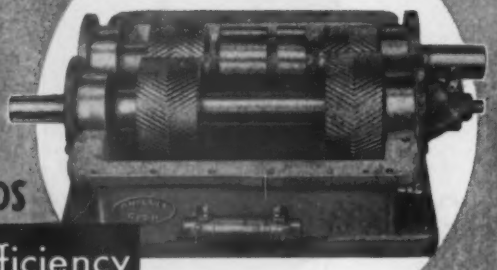

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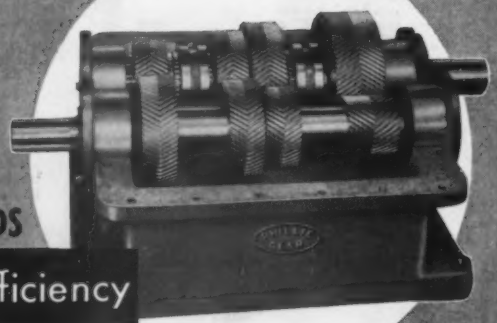

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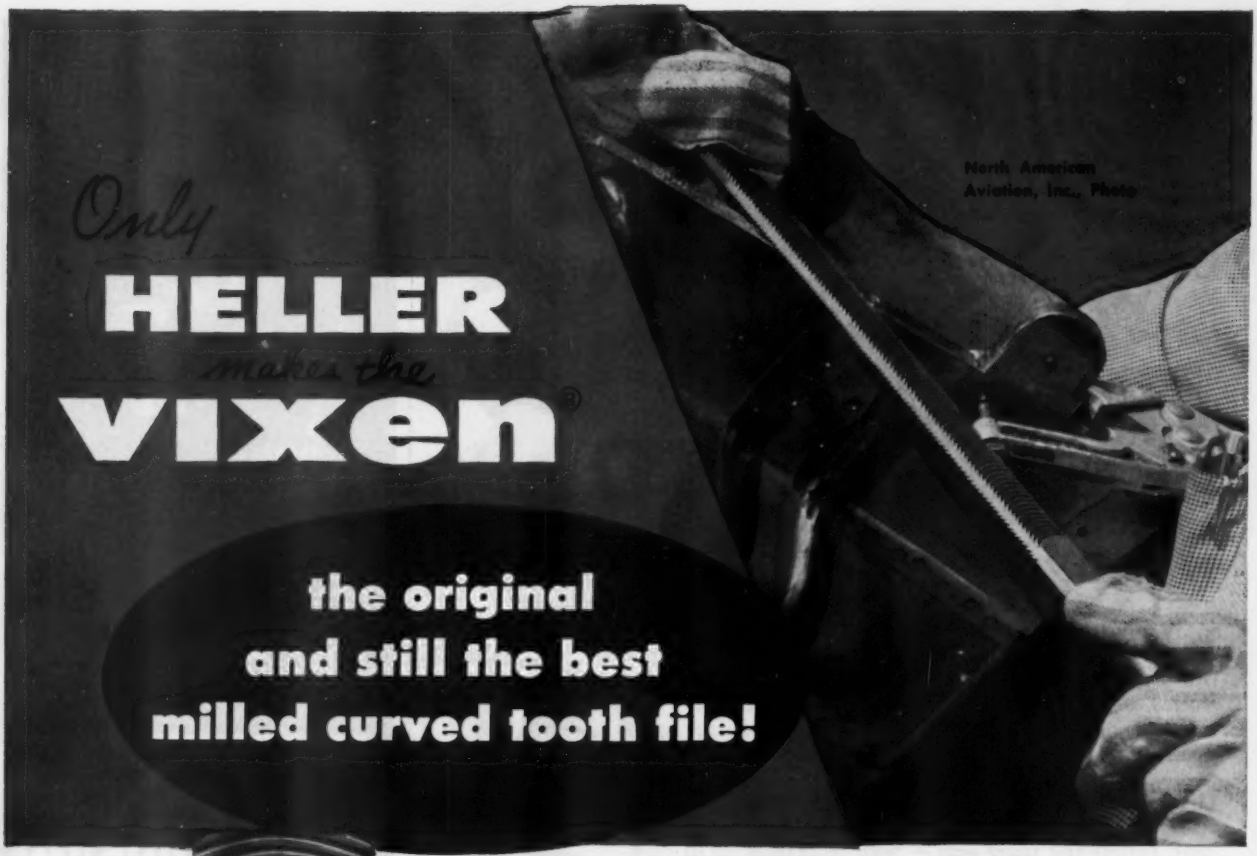

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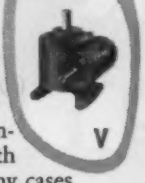

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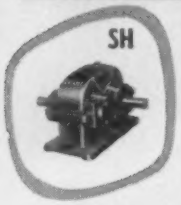

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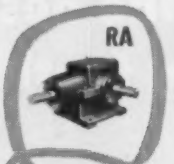

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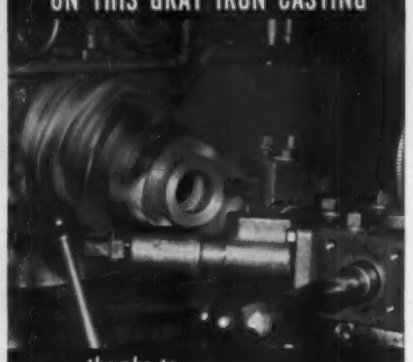

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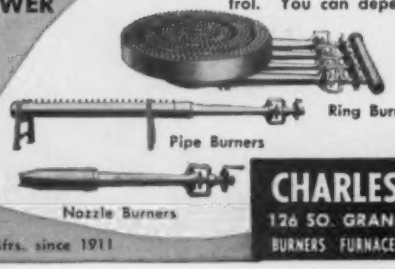

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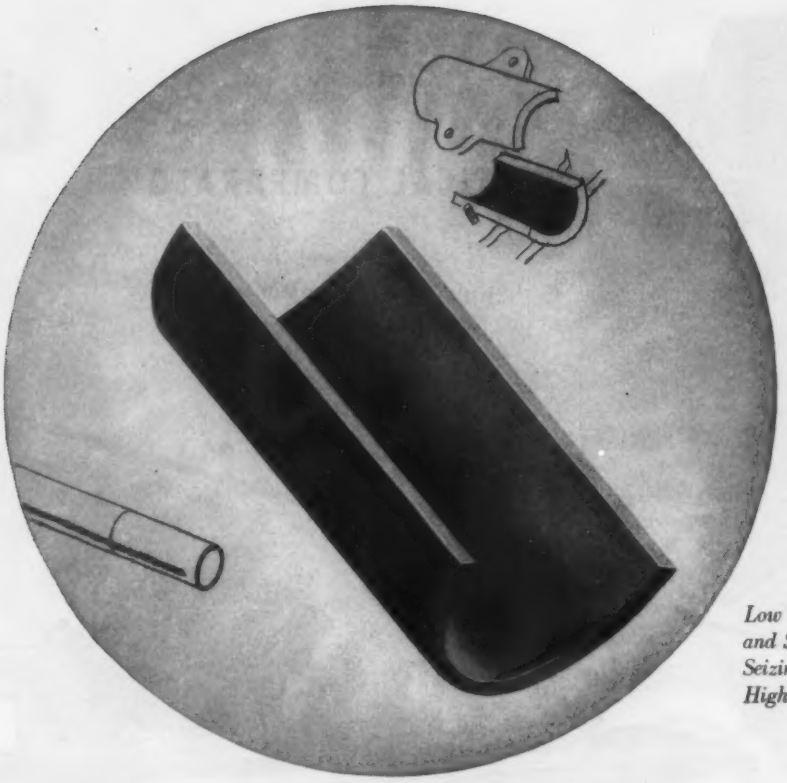

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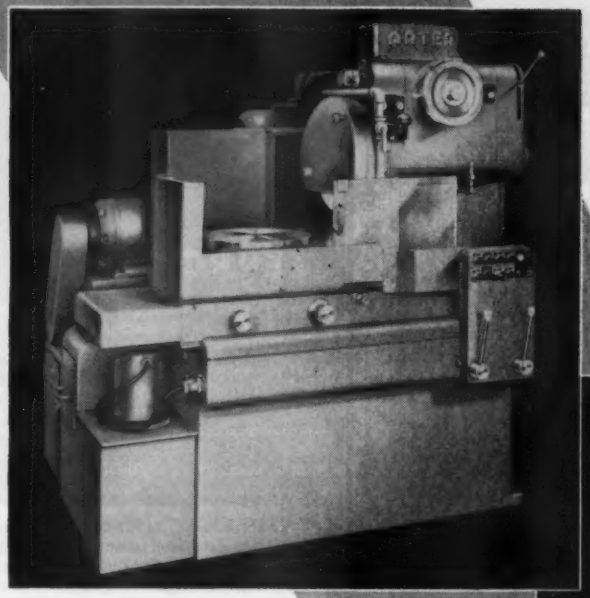

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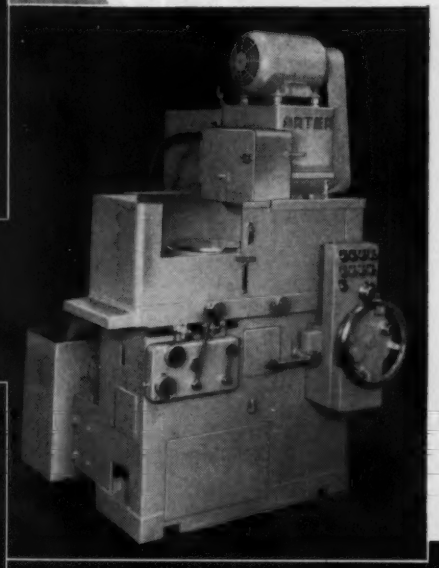

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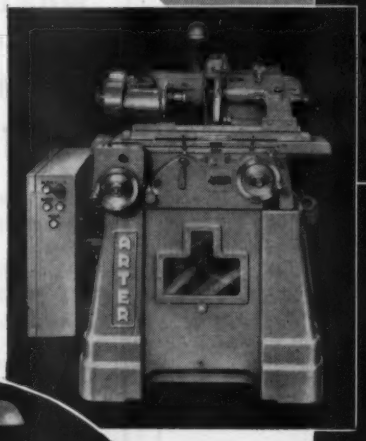

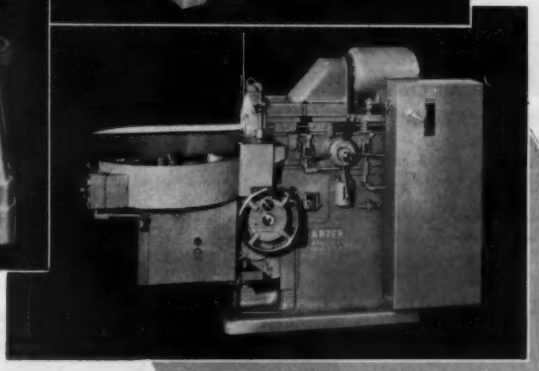

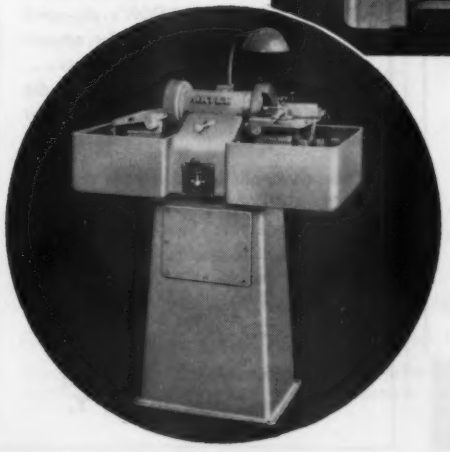

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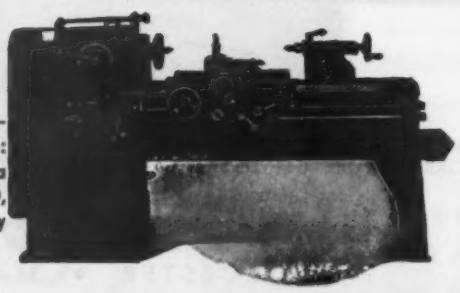

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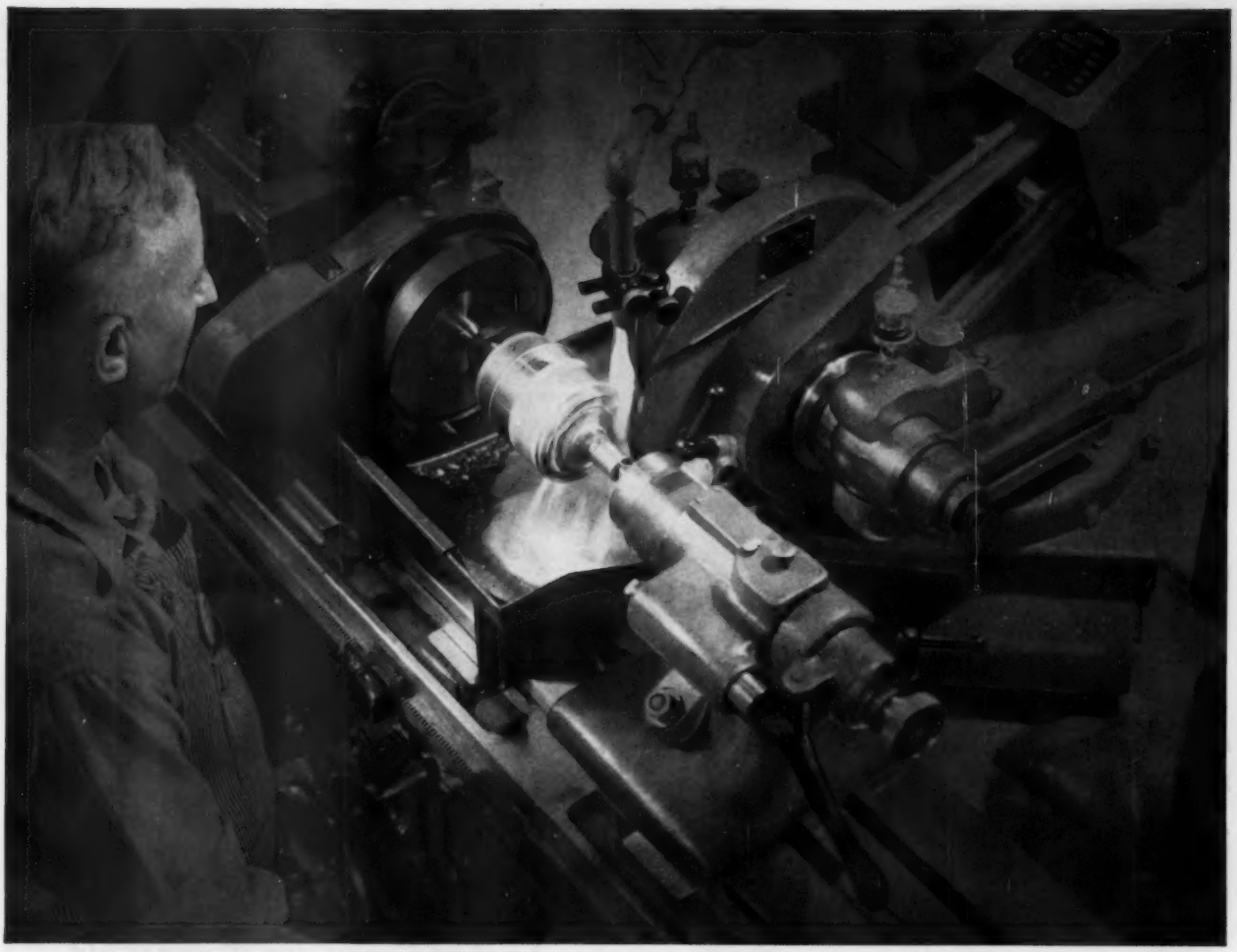

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High speed production grinding has made just *coolants* obsolete! Today's water-mix grinding fluid must provide lubrication, heat dissipation qualities, anti-rust protection and balanced surface tension. If you're using *"just a coolant,"* it's costing you extra money!

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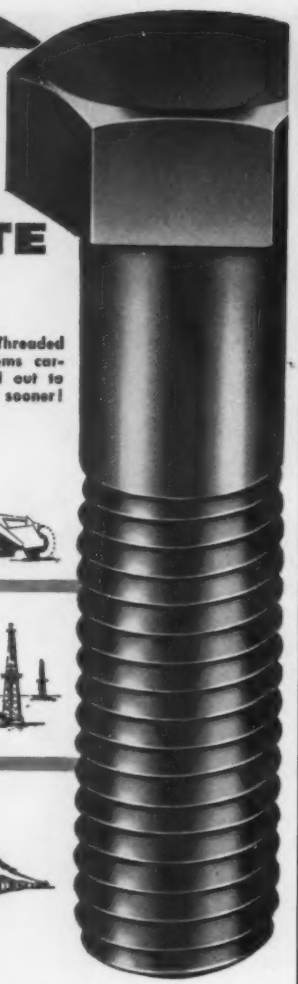

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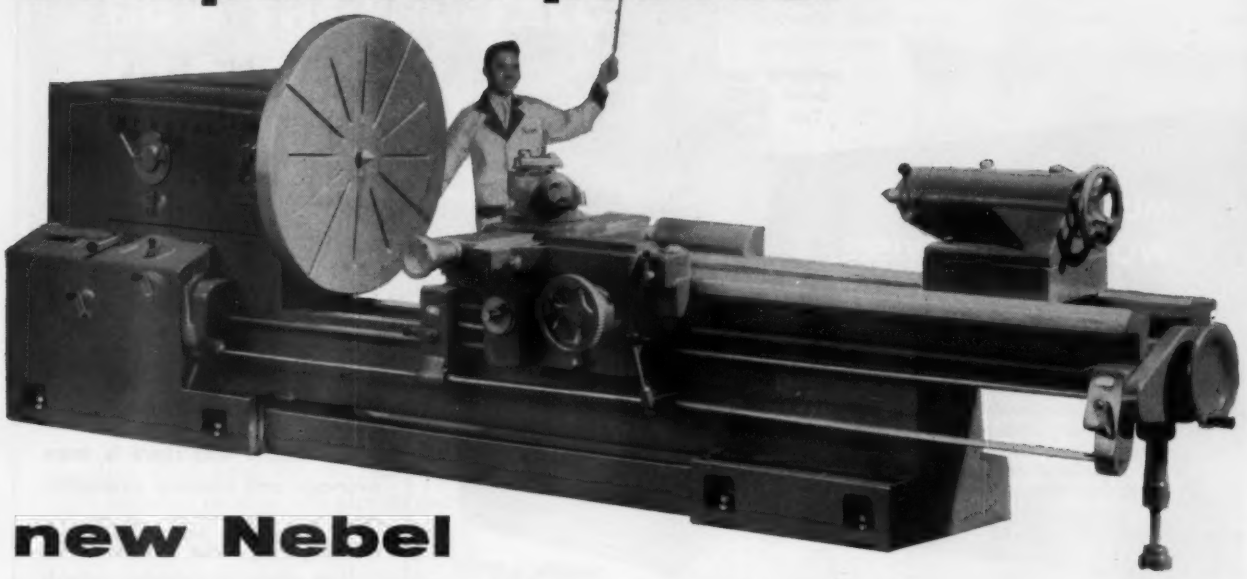

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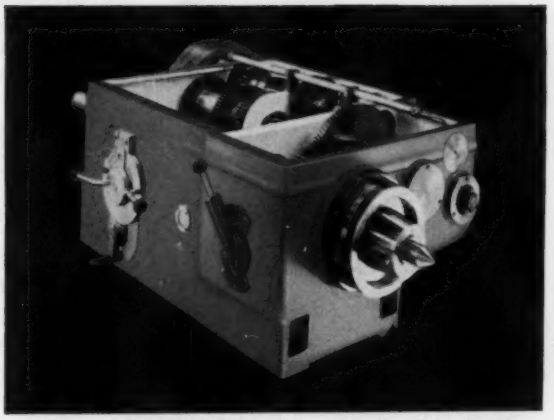

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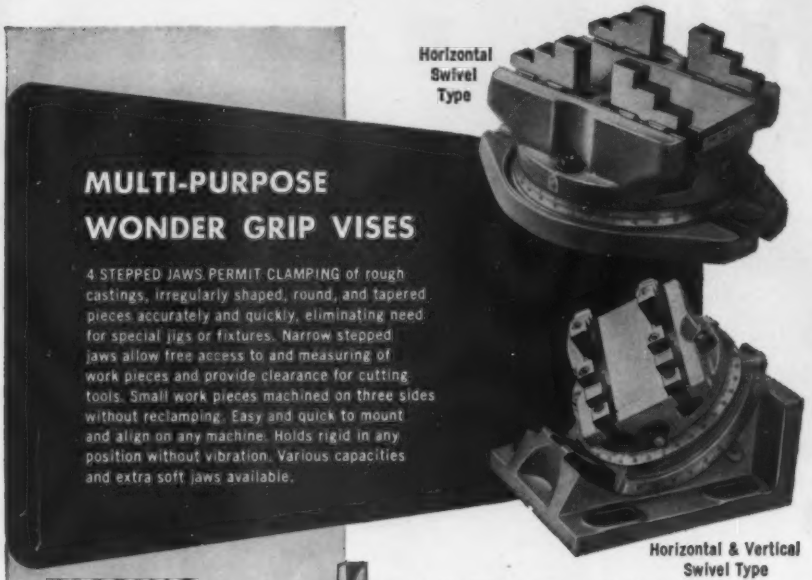

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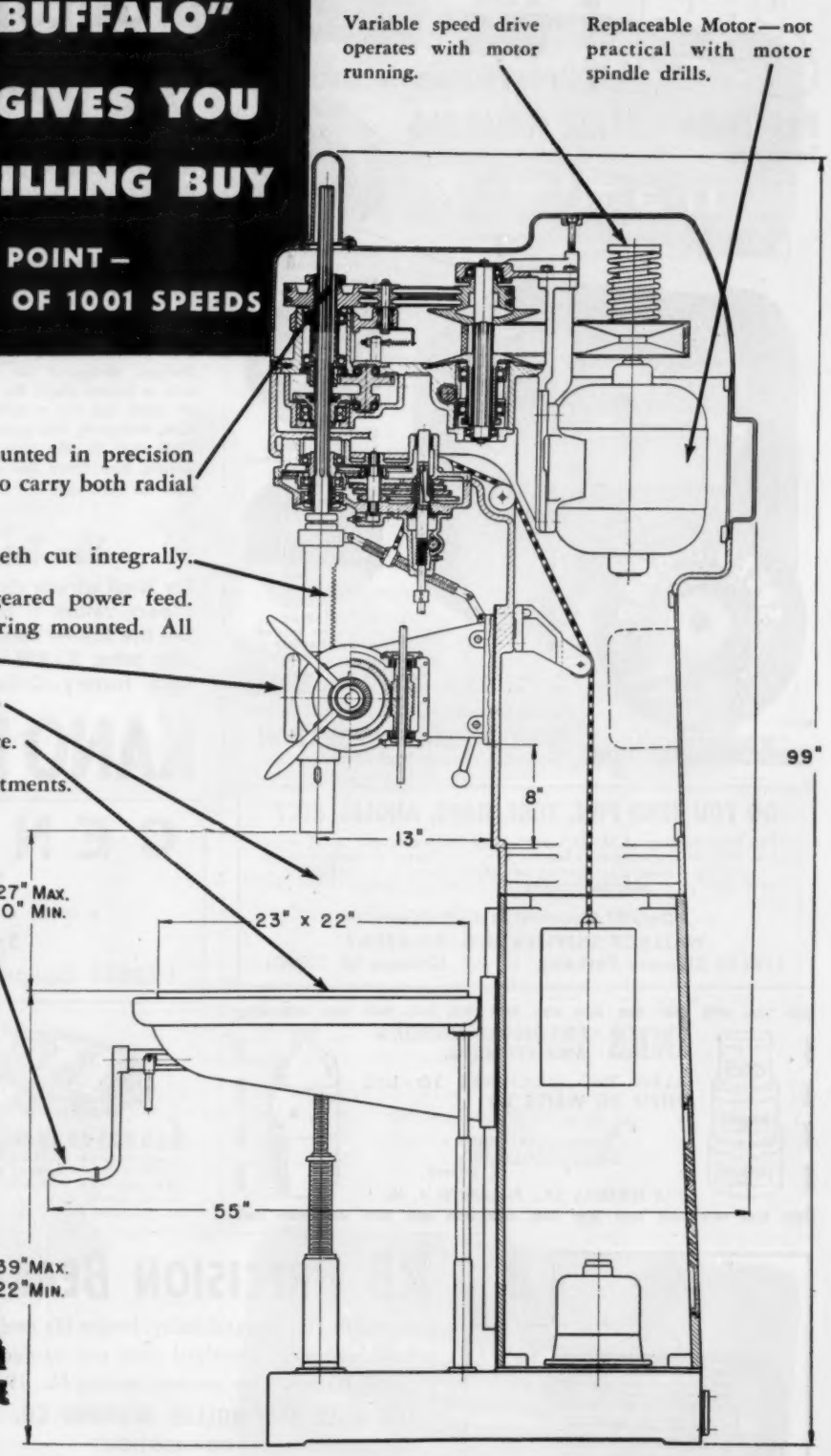

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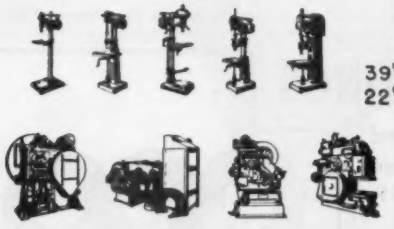

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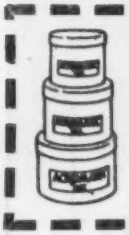

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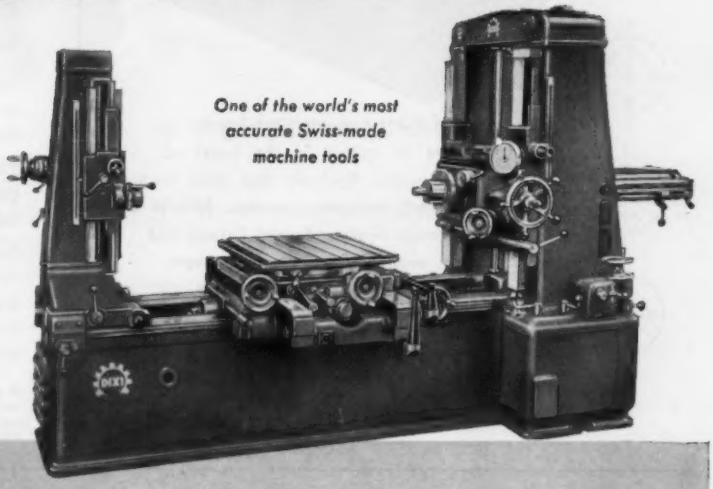

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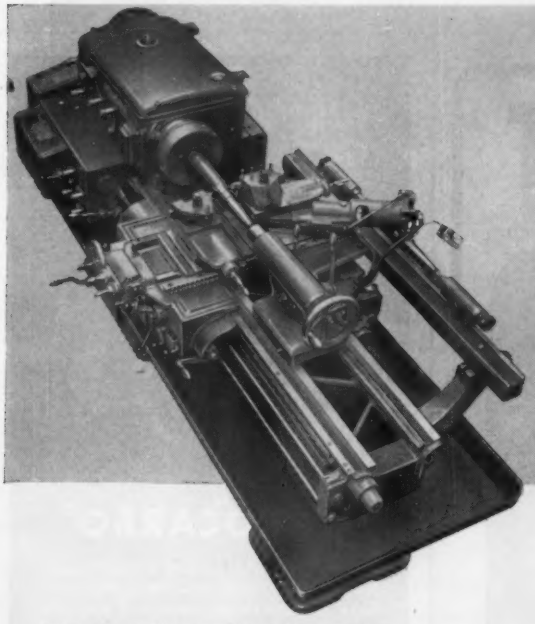

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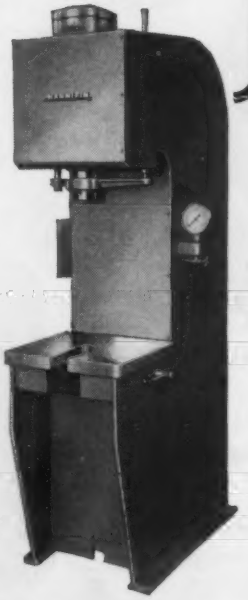

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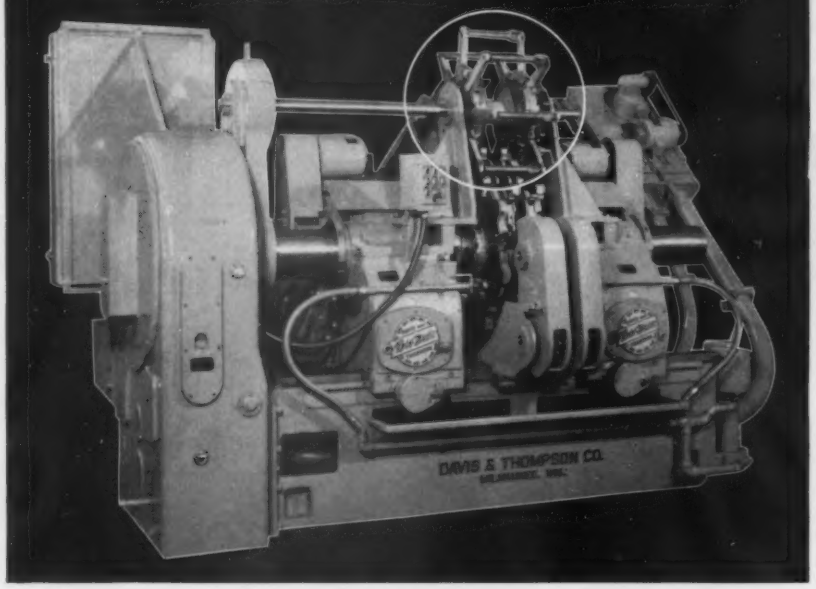

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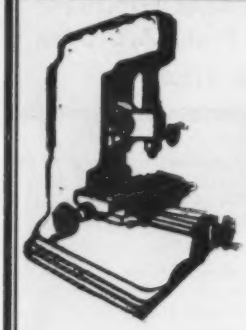

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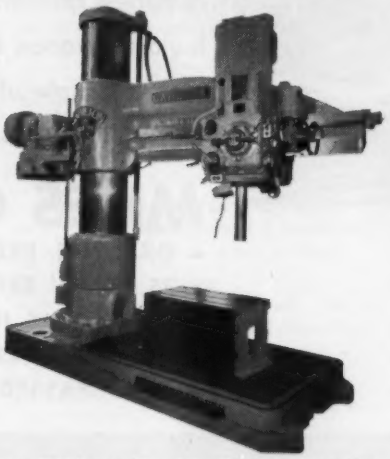

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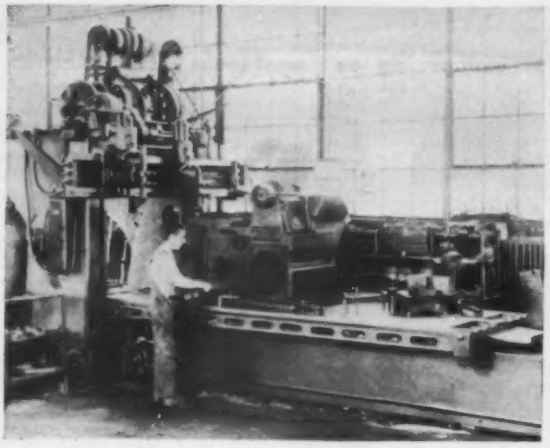

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DRILL, No. 1½ Bx81" Pratt Whitney Duplex Deep Hole Driller, Ser. 173, New '42.
GRINDERS, SURFACE, No. 36 Hanchett, 36" Late
36"x42" P. & W. Vert. Spin. Die & Surf., '47
60" Hanchett, 300 Series, Vert. Spin. Surf.
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GEAR HOBBER—80" capty. No. 4 Pfauter
LATHES—18" x 48" con. Monarch, 1942
SHAPERS—32" Cinci., '41; 24" Cinci. Univ., '40
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No. 3 Baush, m.d., 20x40" head
3 spindle 28" Cincinnati Bickford Upright Drill, m.d., No. 4 M.T.
4 spindle Niles-Bement-Pond, m.d., 12' rail, No. 5 Taper
No. 924 Barnes Vertical Drilling, Boring, Facing & Reaming Machine
6 spindle W. F. & John Barnes Vertical Drilling Machine, m.d.
No. 16 Foote-Burt Fixed Center, m.d.
3 spindle Rockford 12" Gang Drill, m.d.

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D4 Colburn, m.d.
D6 Colburn, Heavy Duty, m.d.
20" Cincinnati Bickford Super-Service Prod. Drill, m.d.
24" Aurora, m.d.
24" Cincinnati-Bickford, m.d.
32" Aurora, belt drive
36" Cincinnati Bickford, belt drive
No. 2 Colburn Mfg. Type, m.d.
No. 315 Baker Heavy Duty, s.p.d.
No. 4—48" Defiance Machine Co. Drill, m.d.
No. 513 Baker, m.d.
B225H Natco Heavy Duty, m.d.
Model 150 Baker Heavy Duty, m.d.

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No. 7, 7A Fellows Gear Shapers, belted m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
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No. 6i Fellows, gear box, m.d.
No. 6IA Fellows, m.d., latest type
No. 64S Fellows, m.d.
No. 645A3 Fellows, m.d.

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No. 72A Fellows, m.d.
No. 75 Fellows High Speed, m.d.
No. 75A Fellows, m.d.
No. 712 Fellows, m.d.
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Gleason Spiral Bevel Gear Rougher, m.d.
No. 3—36" Brown & Sharpe Gear Cutter
No. 4B Fellows Gear Burnisher
No. 8B Fellows Gear Burnisher
3" Gleason Gear Generator, m.d.
8" Gleason Gear Generator, m.d.
11" Gleason Gear Generator, m.d.
Cincinnati Gear Burnisher, m.d.
No. 4—48" Brown & Sharpe Spur Gear Cutter, belt
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9" Pratt & Whitney Hydraulic Spur & Helical
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GG19 Gear Grinding Machine, m.d., latest
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18" National Broach & Machine Co.
18" Gleason Bevel Gear Tester, m.d.
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CENTERLESS GRINDERS

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CARBIDE GRINDERS

#44 Excello Double End
#49 Excello Double End

CRANKSHAFT GRINDERS

18x66" Landis Universal Type C, m.d., late
22"x72" Landis Type CH, m.d., late

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Model FG Micro Cylinder Grinder, m.d.
No. 78 Heald Centerless Cylinder Grinder, m.d.

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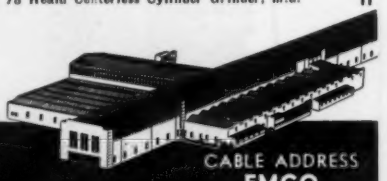

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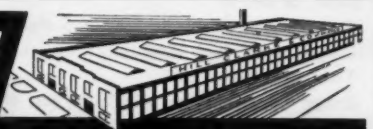

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No. 36BM Gould & Eberhardt
No. 615A Fellows Gear Shaper
No. 612A Fellows Gear Shaper
No. 65 Fellows, Cone Drive
No. 12HS Gould & Eberhardt

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3"x36" Norton Cam-O-Matic
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6"x18" Norton Type C Plain
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14"x48" Landis Type C Plain
14"x48" Landis Univ.
16"x36" Norton Type C Pl.
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18"x120" Norton Type A Plain
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20"-32"x144" Norton Gap
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No. 81 Heald Int. Centerless
No. 74 Heald Int. Centerless
No. 72-A Heald Univ. Int.
No. 72A5 Heald Int. (1942)
No. 72A5 Heald Bridge Int.
No. 5 Bryant Internal
No. 5A Bryant Hole & Face
No. 5B Bryant Internal
No. 16-16 Bryant Internal
No. 16-28 Bryant Internal
No. 16A16 Bryant
No. 16A-28 Bryant Internal
No. 16F-28 Bryant Internal
No. 16-38 Bryant Internal
No. 24-26 Bryant Internal
No. 24-36 Bryant Internal
No. 24L-36 Bryant Internal
A3-16 Arter Surf. (1942)
No. B24—25" chuck Arter Surf.
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#8 Badger Hanchett Double End Disc.
Hill-Clarke Cyl. Norton Type M.D.
10"x36" centers
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10"x96" centers
14"x36" centers
14"x50" centers
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No. 3A Warner & Swasey Turret Lathe
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No. 4A Warner & Swasey (1944)

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No. 1-18 Cinn. Mfg.

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15" Dill Slotter
18" Dill Slotter
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Length of bar feed 16"
Total with reset 22"
Range center line of spindle to top of table below 1", above 36"
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Horizontal and vertical movements:
Quick change feeds, 0.3" to 15" per min. 12
Rapid traverse rate per min. 120"
Bar movement:
Quick change feeds, 001" to .012" per rev. 8
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BL2416 Keller 3 Dim. 1942
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INDEX OF PRODUCTS ADVERTISED IN THIS ISSUE

Accessories & Attachments (Machine Tool) 57, 130, 184

Balancing Machines 51

Bearings ..... 4th Cover, 33, 180, 188

Bending Machines 160

Books, Technical 175, 192

Boring, Drilling & Milling Machines (Horizontal) 14-15, 26-27, 192

Boring Machines Internal ..... 2nd Cover

Boring & Turning Machines (Vertical) 72, Insert Bet. 150A-150D, 192

Brushes 163

Centering Machines 78, 188

Chucks 68, 190

Collets 190

Coolant Systems, Filters & Supplies 154

Cut-Off Machines 86, 170

Drilling Machines 26-27, 44, 67, 70-71, 85, 187

Drill Jig Bushings 74

Dust Collectors 156

Fabricating Methods & Services 157, 166, 170

Fasteners ..... 3rd Cover, 64-65, 184

Files, Hand 165, 173

Gages & Instruments 16, 28-29, 40, 53, 59, 63, 167, 168, 170, 178-179

Gear Cutting Machines 128, 134

Gears, Speed Reducer, Motor Reducers 6-7, 158, 172, 174, 184

Gear Testers 3

Grinders—Cutter & Tool 18-19, 66, 178-179, 181, 202

Grinding Machines—Production 8-9, 10-11, 12-13, 18-19, 56, 58, 62, 81, 178-179, 181, 202

Heads: Drilling, Grinding & Tapping 188

Heat Treating Equipment & Supplies 174

Honing Machines 76

Industrial Financing Plan 20-21

Jig Borers 30-31, 176-177, 182, 189, 192

Lapping Machines 18-19

Lathes, Automatic ..... 22-23, Insert Bet. 32-33, 51, Insert Bet. 56-57, 162

Lathes, Engine ..... Insert Bet. 40-41, 42, 48-49, 60, 182, 185, 189

Lathes, Turret ..... Insert Bet. 32-33, 51, Insert Bet. 56-57, 153

Lubricants, Cutting Fluids, Quenching Oils & Solvents 38, 39, 132, 161, 183, 188

Machines, Super Finishing 51

Marking Machines, Tools & Supplies 188

Materials of Manufacture 43, 54-55, 61, 150A, 154, 169, 174, 180, 182, 190

Materials Handling Equipment 50

Millers, Die Sinkers, Profilers 4-5, 20-21 78, 80, 171

Planers 14-15

Power Transmission 82

Presses, Forging & Forming Equipment & Supplies 34-35, 46-47, 59, 164, 174, 188, 190

Production, Inventory & Tool Control 150D

Pumps, Circulating 154

Riveting Machines 170

Safety & Welfare Equipment 151

Saw Blades 165

Screw Machines; Chucking Machines 17, 45

Shapers, Slotters, Keyseaters 88, 158, 184, 190

Special Machine Tools 36-37

Spindles, Machine 184

Tapping Attachments 186

Tapping Machines 10-11

Thread Cutting Machines 10-11

Thread Rolling Machines & Tools 10-11

Tooling Set-up Equipment 32, 68

Tools, Cutting 24-25, 28-29, 32, 52, 69, 155, 156

Transportation 41

Tumbling Machines 188

Used & Surplus Equipment 195-198

Vises 68, 186

Welding & Cutting, Brazing & Soldering Equipment & Supplies 191

ADVERTISERS INDEX

This index is published as a convenience to the readers. Every care is taken to make it accurate, but AMERICAN MACHINIST assumes no responsibility for errors or omissions.

	Page
Acromark Company	188
Allis-Chalmers Manufacturing Co.	82
American Chain & Cable Co., Inc.	50
American Machinist	175
American Optical Co.	151
American Sip Corporation	176-177
American Steel Foundries King Machine Tool Division	72
American Tool Works	85
Armstrong-Blum Mfg. Co.	170
Armstrong Bros. Tool Co.	32
Arter Grinding Machine Company	181
Baldwin Lima Hamilton Corp.	159
Ball & Roller Bearing Co.	188
Bethlehem Steel Co.	169
Bilgram Gear & Machine Co.	184
Blanchard Machine Co.	56
Brush Electronics Co.	63
Bryant Chucking Grinder Co.	62
Buffalo Forge Co.	187
Bullard Co.	Insert Bet. 150A-150D
Carborundum Co.	174, 182, 190
Carroll & Jamieson Machine Tool Co.	182
Chicago Screw Co.	184
Cincinnati-Bickford Tool Co.	44
Cincinnati Gear Co.	158
Cincinnati Lathe & Tool Co.	70-71
Cincinnati Milling Machine Co.	4-5
Cincinnati Milling Machine Co. Process Machinery Division	36-37
Cincinnati Shaper Co.	46-47, 88
Cities Service Oil Co.	161
Cleveland Crane & Engineering Co.	86
Columbia Tool Steel Co.	154
Columbus Die-Tool & Machine Co.	170
Cone Automatic Machine Co.	17
Covel Manufacturing Co.	178-179
Cross Company	134
Crown Cork & Seal Co.	166
Crucible Steel Co. of America	43, 61
Davis Keyseater Co.	184
Davis & Thompson Co.	192
Disston & Sons, Inc., Henry	165
Eastern Machine Screw Corp.	188
Eastman Kodak Co. Industrial X-Ray	167
Ex-Cell-O Corp.	74
Fellows Gear Shaper Co.	6-7
Foote-Burt Co.	127
Fosdick Machine Tool Co.	30-31
Gallmeyer & Livingston Co.	202
Giddings & Lewis Machine Tool Co.	14-15
Gisholt Machine Company	51
Gleason Works	3
Gorham Tool Co.	69
Goss & DeLeeuw Machine Co.	162
Grant Gear Works Inc.	174
Grant Mfg. & Machine Co.	170
Hancock Manufacturing Co.	190
Hannifin Corp.	190
Hardinge Brothers, Inc.	60
Haynes Stellite Co., Div. Union Carbide & Carbon Co.	180
Heald Machine Company	2nd Cover
Hebert Equipment Co.	188
Heller Brothers Co.	173
Holo-Krome Screw Corp.	3rd Cover
Hones, Inc., Charles A.	174
Johnson & Bassett Inc.	68
Jones & Lamson Machine Co.	Insert Bet. 56-57
Kano Laboratories	188
Kearney & Trecker Corp.	20-21
Kent-Owens Machine Co.	171
King Machine Tool Div. American Steel Foundries	72
Knight Machinery Co., W. B.	182
Landis Machine Co.	10-11
Landis Tool Co.	12-13
LeBlond Machine Tool Co., R. K.	Insert Bet. 40-41
Leland-Gifford Co.	67
Linde Air Products Div. Union Carbide Corp.	191
Link-Belt Co.	33
Linley Brothers Co.	192
Lodge & Shipley Company	42
Mattison Machine Works	58
M.B.I. Export & Import Ltd.	186, 189

ADVERTISERS INDEX

	Page
McGraw-Hill Book Co., Inc.	193
Micromatic Hone Corp.	76
Mitts & Merrill	190
Morse Twist Drill & Machine Co.	24-25
Motch & Merryweather Machinery Co.	78
National Acme Company	45
National Automatic Tool Co.	26-27
National Broach & Machine Co.	128
National Machine Tool Co.	158
National Tool Co.	52
National Twist Drill & Tool Co.	29
Nebel Machine Tool Company	185
Niagara Machine & Toool Wks.	34-35
Norton Company	18-19
Oliver Instrument Co.	66
O'Neil-Irwin Mfg. Co.	160
Osborn Mfg. Co.	163
Parker-Kalon Division General American Transp. Corp.	64-65
Philadelphia Gear Works	172
Pipe Machinery Co.	59
Pope Machinery Corp.	184
Pratt & Whitney Div. Niles Bement Pond Co.	80-81
Railway Express Agency	41
Remington Rand Inc.	150D
Republic Steel Corp.	54-55
Revere Copper & Brass Inc.	150A
Ruthman Machinery Co.	154
Sheffield Corp.	53
Shell Oil Co.	38-39
Shore Instrument & Mfg. Co. Inc.	170
Speed-D-Burr Corp.	188
Spincraft Inc.	157
Springfield Machine Tool Co.	48-49
Standard Automotive Parts Co.	184
Steelweld Machinery Div. Cleveland Crane & Egrg. Co.	86
Stuart Oil Co. Ltd., D. A.	183
Sun Oil Company	132
Sundstrand Machine Tool Co.	22-23
Taft-Peirce Mfg. Co.	40, 57
Timken Roller Bearing Co. Indus. Div.	4th Cover
Torit Manufacturing Co.	156
Union Carbide & Carbon Corp.	180, 191
Vaill Engineering Co.	174
Van Keuren Co.	16
Van Norman Co.	8-9
Virginia Gear & Machine Corp.	172
Vlier Engineering Inc.	130
Wade Tool Co.	153
Waldes Koh-I-Noor Inc.	155
Wallace Supplies Mfg. Co.	188
Warner & Swasey Co.	Insert Bet. 32-33
Webber Gage Co.	168
Wilson, Inc., K. R.	164
Winter Brothers Co.	28
Woodruff & Stokes Co., Inc.	156
Wright Hoist Division American Chain & Cable Co., Inc.	50

CLASSIFIED ADVERTISING

F. J. Eberle, Ass't. Mgr.

EMPLOYMENT OPPORTUNITIES 194

SPECIAL SERVICES
- Contract Work 194
- General Pattern Works 194

EDUCATIONAL
- Books 194

EQUIPMENT
- (Used or Surplus New) For Sale 195-198

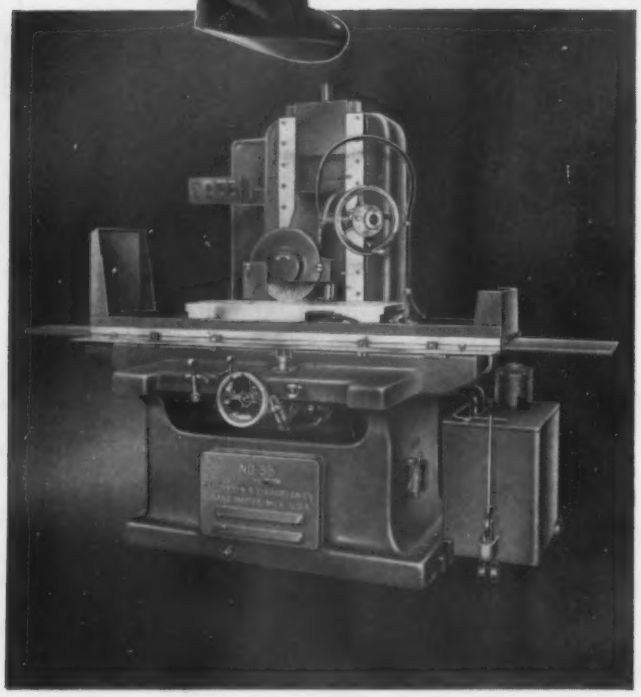
WANTED
- Equipment 198

ADVERTISERS INDEX

- Aaron Machinery Co., Inc. 198
- Bennett Machinery Co. 196
- Brownell Machine Tool, Inc., Hazard 196
- Dony Machinery Co. 198
- Eastern Machinery Co., Inc. 197
- Electric Equipment Co. 196
- Emerman Machinery Corp. 198
- Falk Mill Supply Co., Inc. 195
- Flexible Connector Co. 198
- Hill-Clarke Machinery Co. 197
- Hyman & Sons, Jos. 196
- Indianapolis Machinery & Supply Co. .. 197
- Lucas & Son., Inc., J. L. 196, 197, 198
- Machine Tool Publications 194
- Miles Machinery Co. 196, 197
- Motch & Merryweather Machinery Co. 195
- National Machinery Exchange 198
- Noll Equipment Co. 198
- Peacock Corp. 194
- Reynolds Metals Co. 194
- Williams, E. H. 198

FOUND WHERE WORLD FAMOUS AIRCRAFT ARE "BORN"

GRAND RAPIDS GRINDERS



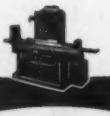
GRAND RAPIDS NO. 55 HYDRAULIC FEED SURFACE GRINDER
This precision tool room type machine has table speed up to 125 fpm. Working surface of table is 12" x 36". Vertical movement of wheel head 18". Preloaded ball bearing spindle greased for life. Spindle speeds 1925 and 2500 rpm.

Just a note on your letterhead will bring you full details.

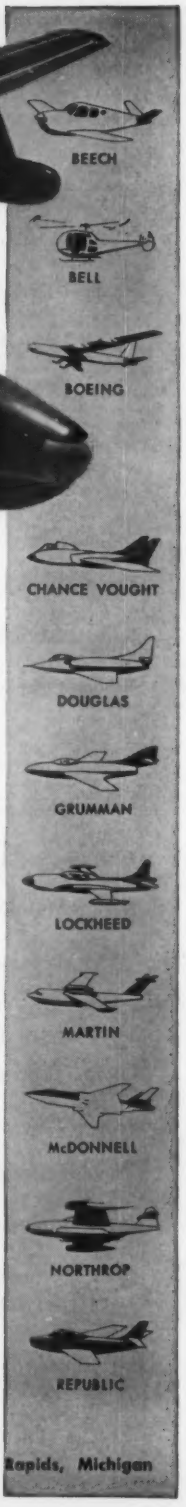
Just take a look in their toolrooms! Every one of these famous aircraft manufacturers uses Grand Rapids Grinders . . . depends on them for the uncompromising precision on which records and reputations are made.

Grand Rapids Grinders are engineered and built for unusual long life of precision grinding. Our Model 55 shown here, for instance, features column and base of massive, one-piece casting for vibrationless rigidity and permanent alignment. Both longitudinal table travel and cross feed are hydraulically actuated. Wheel head has powered rapid vertical travel. Table speed is variable up to 125 fpm . . . faster than any other of this type and size.

That's why so many tool room men insist on Grand Rapids Grinders.



GALLMEYER & LIVINGSTON



GALLMEYER & LIVINGSTON COMPANY 430 Straight Ave., S.W., Grand Rapids, Michigan

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For your copy of any new catalog or bulletin, circle key number in the space indicated. Bulletins are described on pages 154 to 158.

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To get more information about advertised products, circle the page number of the advertisement in which you are interested. If more than one advertisement is located on a single page, letters preceding number identify each advertisement. Key: T—Top; B—Bottom; R—Right, L—Left; TL—Top left, BL—Bottom left, TR—top right, BR Bottom right.

Requests for information made through *American Machinist* Readers' Service will be forwarded to the manufacturer as quickly as we can process them. If you write directly to the manufacturer, please identify advertisement by issue and page number to facilitate reply.

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30-1	32	32a-b	33
34-5	36-7	38-9	40
40a-d	41	42	43
44	45	46-7	48-9
50	51	52	53
54-5	56	56a-d	57
58	59	60	61
62	63	64-5	66
67	68	69	70-1
72	74	76	78
80-1	82	85	86
88	127	128	130
132	134	150a	150b-c
150d	151	153	T154
B154	155	L156	R156
157	T158	B158	159
160	161	162	163
164	165	166	167
168	169	L170	TR170
CR170	BR170	171	172
173	TL174	BL174	TR174
BR174	176-7	178-9	180
181	TL182	BL182	TR182
183	L184	TR184	TCR184
BR184	BCR184	185	TL186
187	TL188	TCL188	B188
BCL188	TR188	TCR188	BCR188
189	TL190	BL190	TR190
BR190	191	TL192	BL192
193	202	C3	C4

BULLETINS		
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	

NEW EQUIPMENT	
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	

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30-1	32	32a-b	33
34-5	36-7	38-9	40
40a-d	41	42	43
44	45	46-7	48-9
50	51	52	53
54-5	56	56a-d	57
58	59	60	61
62	68	64-5	66
67	68	69	70-1
72	74	76	78
80-1	82	85	86
88	127	128	130
132	134	150a	150b-c
150d	151	153	T154
B154	155	L156	R156
157	T158	B158	159
160	161	162	163
164	165	166	167
168	169	L170	TR170
CR170	BR170	171	172
173	TL174	BL174	TR174
BR174	176-7	178-9	180
181	TL182	BL182	TR182
183	L184	TR184	TCR184
BR184	BCR184	185	TL186
187	TL188	TCL188	B188
BCL188	TR188	TCR188	BCR188
189	TL190	BL190	TR190
BR190	191	TL192	BL192
193	202	C3	C4

BULLETINS		
1	2	3
4	5	6
7	8	9
10	11	12
13	14	15
16	17	18
19	20	21
22	23	24
25	26	27
28	29	30
31	32	33
34	35	36
37	38	39
40	41	42
43	44	45
46	47	48
49	50	

NEW EQUIPMENT	
51	52
53	54
55	56
57	58
59	60
61	62
63	64
65	66
67	68
69	70
71	72
73	

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Every Holo-Krome distributor can fill your order Same-Day from his own stock—or guarantee Same-Day shipment of your order from the Holo-Krome factory stock*

We invite you to call *your* Holo-Krome distributor for a brand of service never before enjoyed by users of socket screw products. Every day, more and more people specify Holo-Krome—because the *price* is right, the *delivery's* right, and the *quality's* always *best!*

*Same-Day Service on All Standard Catalog Items!

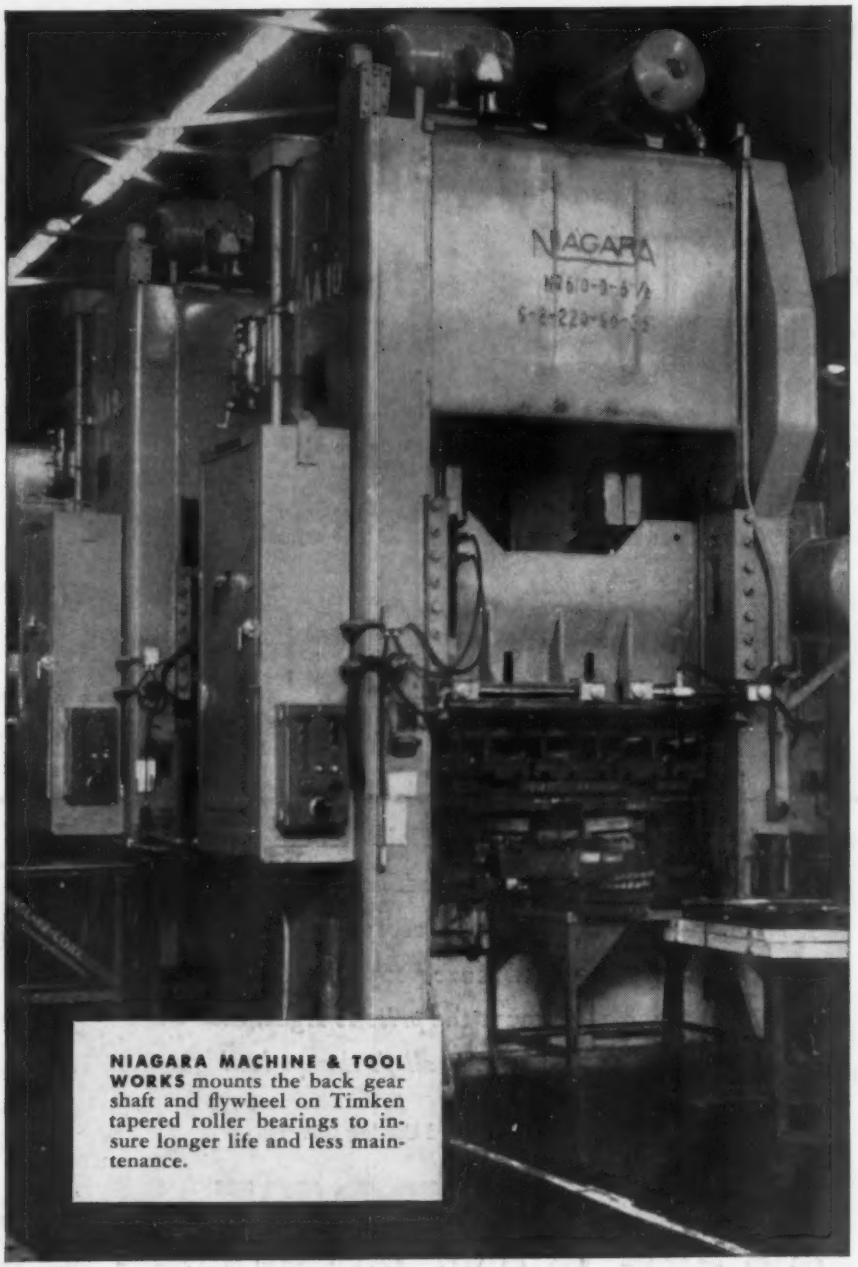
HOLO-KROME SAME DAY SERVICE

SEE YOU AT BOOTH 431

PRODUCTION ENGINEERING SHOW
NAVY PIER, CHICAGO, ILL.
SEPTEMBER 6-16

THE HOLO-KROME SCREW CORP. • HARTFORD 10, CONNECTICUT, U.S.A.

How TIMKEN® bearings cut maintenance on auto body stamping presses



NIAGARA MACHINE & TOOL WORKS mounts the back gear shaft and flywheel on Timken tapered roller bearings to insure longer life and less maintenance.

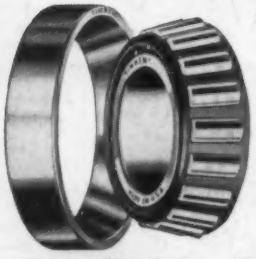
MAINTENANCE and downtime are low in the stamping department of one large automotive manufacturer. One reason: 30 new-design Niagara double crank presses have the back gear shaft and flywheel on Timken® tapered roller bearings.

Every time the press stamps a part, the bearings on the back gear shaft take the heavy shock load. Timken bearings take these loads with ease because rollers and races are case-hardened. This gives them a hard, wear-resistant surface over a tough, shock-resistant core. Full line contact between rollers and races of Timken bearings gives them extra load carrying capacity to hold shafts in line. There's minimum maintenance, less downtime.

Timken bearings help gears last longer, too. They insure accurate gear mesh because Timken bearings' tapered construction lets them take both radial and thrust loads in any combination. The taper prevents lateral movement of the shaft. Flywheels do not become worn or loose, crankshaft wear is prevented.

Be sure to specify Timken bearings for all the machinery you build or buy. They give longer life with less friction. Look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, O. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

PROFILOGRAPH TRACE. GOOD COMMERCIALLY GROUND FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)

PROFILOGRAPH TRACE. TIMKEN BEARING FINISH (5,000 X VERTICAL, 30 X HORIZONTAL)

OPTICAL FLAT. PERFECT FINISH

SMOOTH TO MILLIONTHS OF AN INCH

Surface finish of high quality Timken bearing rollers and races is so smooth that it takes a profilograph to measure its smoothness. This instrument measures surface variations to a millionth of an inch, as shown at the left

NOT JUST A BALL — NOT JUST A ROLLER — THE TIMKEN TAPERED ROLLER — BEARING TAKES RADIAL AND THRUST — LOADS OR ANY COMBINATION